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ABSTRACT

This environmental education program emphasizes the cause and effect of change in a barrier beach ecosystem with special attention given to man and his role in environmental change. Concepts are employed from the natural and social sciences to investigate environmental problems. The units are designed around these questions: (1) What is an ecosystem?; (2) What is a description of the ecosystem being investigated?; (3) What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?; (4) Where are some specific locations of the ecosystem being investigated?; (5) What biotic and abiotic features in the ecosystem have changed and are undergoing change?; (6) What are the natural factors causing change in the ecosystem and how have they been brought about?; (7) What are the man-made factors causing change in the ecosystem and how have they been brought about?; (8) What are the results of the changes?; (9) What, if any, new changes are needed in the ecosystem?; and (10) How might these needed changes to the ecosystem be brought about? The units are inquiry oriented and contain learning activities, resources, evaluation techniques, and teacher suggestions for implementation of the program. Readings, maps, and other handouts are given for learner use. Slides with descriptions are included. (Author/MR)

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Man's Impact on the Environment

The Barrier Beach as an Ecosystem

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MAN'S IMPACT ON THE ENVIRONMENT

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MAN'S IMPACT ON THE ENVIRONMENT

An Environmental Learning Unit

Developed as a portion of the

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"BROAD SPECTRUM ENVIRONMENTAL EDUCATION PROGRAM"

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RATIONALE

Environmental degradation is recognized as a concern of increasing magnitude. Man is the precipitating factor in the deterioration of the human and non-human factors of his environment, his highly touted accomplishments notwithstanding. It is postulated that environmental problems are exacerbated by man's lack of knowledge and understanding of his surroundings, both physical and social, as well as individual motivation to act respectfully toward his environments.

This broad spectrum environmental education program has been developed to combat this shortage of understanding and feeling. Employing concepts from both the disciplines of natural and social sciences, a learner can be exposed not only to the physical phenomena that are being affected in his environment but also can be made aware of the human consequences of these changes. The application of the self-discovery techniques used in this learning activity package will result in a learner who:

1. Demonstrates a significantly increased level of knowledge and understanding of the interrelationship of both human and non-human aspects of his environment.
2. Demonstrates a significantly higher positive attitude toward his environment.

By accomplishing these objectives with a substantial number of students, they would be equipped with the basic tools with which to actively pursue solutions to environmental problems.

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FOREWORD

Man's Impact on the Environment is a learning activity package designed to foster an improvement in the learner's knowledge of and attitude toward his environment. As the title might suggest, this package views man as he affects his environment, both the living and non-living features. Consequently, the unit of analysis used for this study is the ecosystem, a system in which the many relationships among the living (biotic) and non-living (abiotic) aspects of any given environment are investigated.

The ecosystem view of the environment is brought into sharp focus by utilizing the conceptual theme of change. Biological, physiological, and sociological change are all facets of this particular conceptual approach. Major emphasis is given to the cause and effect of change in an ecosystem and special attention is given to man and his role in environmental change.

To facilitate the investigation of change in various ecosystems, an analytical model - a series of generalized but basic questions applicable to a number of similar units of analysis - about change in an ecosystem has been developed. In Man's Impact on the Environment, learning activities are provided that apply this analytical model to a series of specific ecosystems: barrier beach, estuary, freshwater marsh, the city. It is believed that once a learner becomes acquainted with this model, he can use it as a guide to study any ecosystem he wishes.

The application of this model to selected ecosystems is made through an inquiry, or self-discovery, learning approach. Even though the learning activities are based on a very directed inquiry technique, the learner still benefits from using his analytical skills, gaining facts, and exploring and clarifying his values and attitudes toward the environment.

How To Use This Learning Packet

This learning activities package is divided into three major sections -- Learning Activities, Student Comments (SC) and Teacher Comments (TC). The Learning Activities section provides investigations for each inquiry question listed in the analytical model. These investigations are designed to guide the learner toward a well grounded conclusion to the inquiry questions. Along with the Learning Activities, this division includes **Resources** needed to complete the investigations, suggested **Evaluation** procedures for student performance, and **Teacher Suggestions**. The evaluation techniques are explained in depth later in this **Foreward**. Student **Comments** are readings, maps, and other handouts that are integral parts of the Learning Activities and are to be reproduced for learner use. The Student Comments are numbered and located all together following **the section on** Learning Activities. Teacher Comments give background information on a variety of aspects of the ecosystem being studied. Even though the Teacher Comments are primarily designed for the teacher, many instructors have found it useful to reproduce these for their students to use.

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In an effort to make this learning packet as student-oriented as possible, there has been included an explanation of a workable program in which students conduct class discussion. Read carefully the following Suggested Model for Student-Directed Class Discussion for possible implementation in your classroom.

Man's Impact on the Environment also provides a series of suggested methods for evaluating learner performance. Employment of these particular techniques are not critical to the success of the learning unit, but are procedures that have proved meaningful to the classroom teachers who developed this learning activity package. A Proposed Scheme of Techniques for Evaluating Student Performance merits close attention and can be found in this **Foreward**.

A Suggested Model for Student-Directed Class Discussion

"The only learning which significantly influences behavior is self-discovered, self-appropriated learning. Self-appropriation or 'learning it for myself' happens when there is process, or when the student is an activist . . . or when the student is searching, or when the student is doing anything with the teacher -- like understanding or loving him."*

One process that can be actively utilized for self-discovered learning is the student-directed class discussion. Discussion revolving around challenging, inquiry oriented questions supplied by the teacher, but conducted exclusively by the students, will provide the participants the opportunity for active involvement. Student-directed discussions allow the student to express opinions openly and argue freely for his point of view in an atmosphere monitored by his peers instead of the, more often than not, staid question and answer situation structured by the teacher.

Class discussions directed by students also free the teacher to become a sharper observer of student interaction, a better listener, and more effective evaluator. By allowing students the chance to conduct class discussions and refraining from voicing personal opinions and making authoritative statements, the teacher will have more time to observe, listen, and evaluate. Student confidence is developed when the teacher allows them to work out their own problems and acts as a guide and not the sole intellectual authority in the room. Teacher suggestions should be offered sparingly and only if students get too far off the subject and just can't get back to the business at hand.

One highly successful model for student-directed class discussion has been employed for several years in social studies classes at DeLaura Junior High School, Satellite Beach, Florida.

* Carl Rogers

Students assume the three following positions: (1) Moderator, (2) Board Recorder, (3) Desk Recorder. These positions are all voluntary and students may choose to be one, two, or all three, not all at once. A sheet of paper for each position may be passed around the room, and students may sign up for any, all, or none of these. When any position is needed, the teacher can just pick one student, starting at the top of the list. Moderator and Board Recorder serve one class period and the Desk Recorder serves throughout the entire discussion of the overall issue. These positions are excellent for those quiet, shy students who hesitate to express their opinions in a large group. A teacher should award extra points to those students who volunteer for these positions.

(1) The Moderator - Responsibilities

A. Calls on students who wish to express themselves.

B. Continues to call on students who wish to speak as long as there is quiet cooperation of the remaining students.

C. Maintains parliamentary procedure. (Simple parliamentary procedure might be explained by the teacher -- point of order, call for question, making a motion, etc.)

D. Does not express an opinion.

(2) The Board Recorder - Responsibilities

A. Records pertinent information on chalkboard as directed by students so that the Desk Recorder can make a copy of the information for the class log and help keep discussion on the point.

B. May express opinions when recognized by the Moderator.

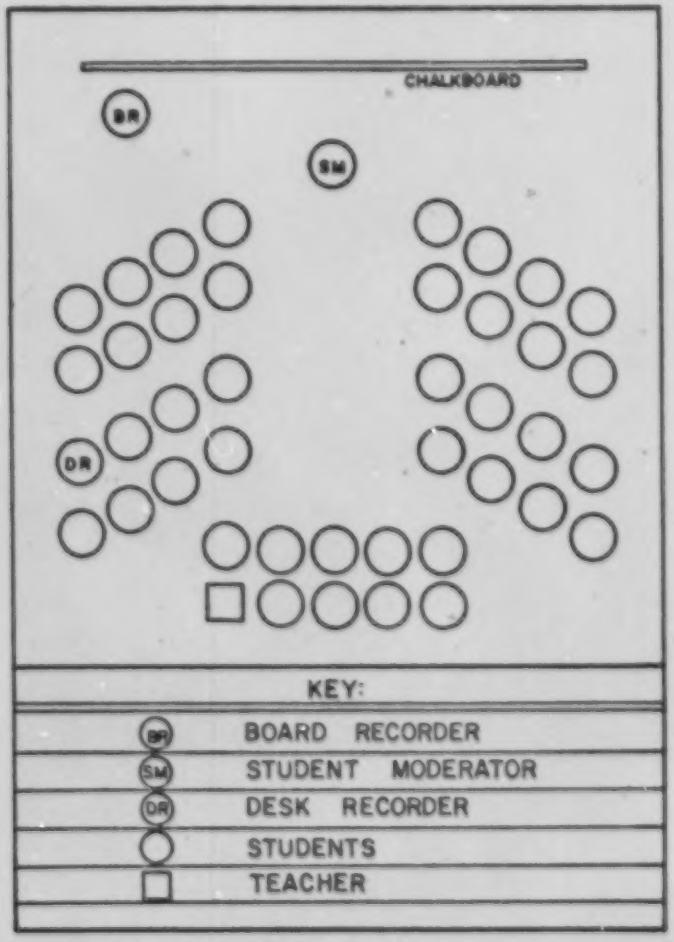
(3) The Desk Recorder - Responsibilities

A. Records in a class log information exactly as it appears on the chalkboard.

B. Acts as secretary when arguments occur over previous material by referring to previous records in log.

C. Places previous day's work on chalkboard at the beginning of each class meeting.

D. Records information on ditto at the conclusion of the discussions for distribution to members of the class.



Physical arrangements of the class environment contribute significantly to class discussion. Desks should be situated so that students can generally face each other for easier interaction and see the chalkboard without difficulty. See diagram at left.

Remember! The teacher is an observer, listener, and evaluator! One suggested scheme for evaluating large group discussion is explained in the next section on Evaluation Techniques. If this Student-Directed Class Discussion is to be adopted in your classroom, thorough explanation should be made to your students before starting the unit of study.

-David MacDonald, June Schmidlkofer
Social Studies teachers
DeLaura Junior High school
Satellite Beach, Florida

A Proposed Scheme of Techniques for Evaluating Student Performance

Evaluating student performance is difficult at best. Most classroom teachers have developed systems for "grading" their students with which they are most comfortable. Other teachers are quite uncomfortable with any techniques for measuring student progress. We make no attempts at solving the problems and inequities inherent in most evaluation schemes. We only present some ways that some classroom teachers have used and have found to be successful for them. Please review the suggested methods included here and modify for use in your own situation. Whatever general evaluation process is chosen, explain its function to your students before beginning the unit of study.

Student achievement can be evaluated on more than written tests, even though these have their place. Additional areas of measurement may include large group discussion, small group work, self-evaluation, oral reports, visual creations (posters, charts, graphs, diagrams, collages), and written assignments.

One suggested method of scoring these and other areas is through a point system in which a higher number of points reflects higher quality. A point scale is established for each area being judged, points are granted either by students or teacher for an individual's performance and each student records his own accumulation of points. This record could take the form of an Individual Point Sheet (I.P.S.) shown on the next page. The sheet serves as a summary for points given in the four categories of evaluation discussed in this section on Evaluation Techniques. Other aspects of evaluation, not included on the Individual Point Sheet may be included at the teacher's discretion. Be creative and reward your students for the good they do. Accentuate the positive and eliminate the negative.

Point Sheets are kept for one week at a time by the student who totals his points and then turns them in to the teacher. At the end of a standard grading period, all I.P.S. totals are added and the teacher converts them into a grade.

Each of the divisions on the I.P.S. are explained on the following pages and detailed scoring instruments are provided for your consideration in the Teacher Comment section.

INDIVIDUAL POINT SHEET	
Total Points _____	Name _____ Period _____ Week _____
Large Group Discussion Points M. T. W. Th. F. Sub-total _____	Self-Evaluation Points M. T. W. Th. F. Sub-total _____
Small Group Work Points M. T. W. Th. F. Sub-total _____	Oral-Visual-Written Points M. T. W. Th. F. Sub-total _____

Large Group Discussion

Large group discussion is probably the most widely used learning technique in the classroom. Most of the time this type of discussion is teacher-centered or directed. However, it is possible for class discussions to be student directed; this leaves the teacher free to be an observer, listener, and evaluator. The section, A Suggested Model for Student-Directed Class Discussion, page ix, gives details in how to establish a student-directed discussion.

With students directing class discussion the teacher has the opportunity to become a more reliable evaluator. Most teachers have their own methods for judging their students' comments as a group discussion progresses, however for those instructors who may wish some help in this matter we have included a sample checklist in the Teacher Comment Section as a possible measuring device.

Large group discussions are used frequently throughout this unit of study, especially as a technique for summarizing or reaching a concluding answer to the Inquiry Question being investigated. Class discussion has been shown to be one of the students' favorite means for learning, therefore it is an excellent opportunity for the teacher to evaluate young people's thinking and expression. If the suggested checklist mentioned above is to be employed, explain its use to the students before the unit of study is begun.

Small Group Work

Small Group Work is an effective method used to develop communication, cooperation, self-expression, leadership, creativity, interaction and sharing of ideas and knowledge. This technique is successful with students in most learning situations.

The purpose of this technique is to develop a student-centered classroom rather than a teacher-directed classroom. Through these small group discussions, students feel freer to express themselves and some develop leadership skills which are not present in large groups. Other benefits are that students learn to work or cooperate with a variety of their peers and not just the same group all the time. Most students learn to cope with a new situation and/or problem to solve. It is imperative that a teacher strive to allow students to solve their own group problems. Teachers should allow students in small groups to elect their leadership except in No. 4 (Captain-selection) of the ideas below.

Here are some suggested ways to organize students into small groups.

1. Counting-off
   a. Decide the number of groups needed.
   b. Suggest four to six members in each group.
   c. Start count anywhere in the room with #1 and go to desired number (4-5-6).
   d. Continue counting off until all students are members of a group.

2. Drawing numbers
   a. Same as No. 1a above.
   b. Same as No. 1b above.
   c. Put in a box the desired sets of numbers.
   d. Students will draw from the box a numbered slip of paper which will determine their group.

3. Self-grouping
   a. Arrange furniture prior to class meeting for desired number of groups.
   b. Choice of location selected by student upon entering the room.

4. Captain-selection
   a. Count off and select desired number such as every tenth person from the rollbook. Student has choice of being or not being a captain.
   b. Continue this until the desired number of captains have been obtained.
   c. Position captains at various stations in the room, as selection is being made.
   d. Captain selects team members. Captain's position is rotated among team if desired.
   e. Continue until all members of the class are on a team.

- David McDonald, June Schmidlkafor
Social Studies Teachers
DeLaura Junior High School
Satellite Beach, Florida

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Many teachers refuse to incorporate small group work in their classrooms because they lack a satisfactory procedure for evaluating the outcome of such efforts. For the purpose of this unit of study, we suggest the use of the following process for checking the results of groups investigating each Inquiry Question. Use only where it is practical to do so.

1. At the end of the study of each Inquiry Question, there will be an exercise in the Learning Activities column entitled Check I. Q. At this point have each individual within a small group write out what he thinks is the answer to the Inquiry Question, by filling out the upper half of the I. Q. (Inquiry Question) Check form provided in the Student Comment section.

2. Teacher collects I. Q. Check sheets and gives to a different small group for grading.

3. Class members will:
   a. Have in front of them a copy of class conclusion for the Inquiry Question arrived at during the Investigations.
   b. Decide how many total grade-points should be possible for the proper response to the Inquiry Question.

4. Each small group will compare the answer sheet handed it with class conclusion and then fill out the lower half of the I. Q. Check form. Experience has shown that more honest and serious evaluations are made when students do not know who is checking whose paper. The name of the checker on the I. Q. Check form is for the teacher only.

5. Return I. Q. Checks to teacher who may reveal scores to students.

If this method of evaluation is employed, it would be essential for students to remain in the same small group until completion is made of all investigations for any one Inquiry Question.

Self-Evaluation

Appraising one's own progress is probably the most effective means of evaluation. No one better than the student himself knows how interested he was in the subject, how clearly he understands the concepts, how much effort was expended on the learning activities, or how much cooperative participation he took in group ventures. A system of self-evaluation can guide a student to a place where he can see his own strong features as well as weak ones. From this vantage point, he can begin to make constructive changes in his behavior.

In the Student Comment Section there is provided one sample measuring device which could be utilized throughout this unit of study. If this instrument or some similar form is adopted, please explain its use to students before any learning activities start.

Oral - Visual - Written Assignments

Variety is a key to comprehensive evaluation of student progress. Oral reports, visual creations and written assignments are but a small list of activities that can be used to measure the growth of students. While formal oral presentations are at a minimum in these units of study, they may be required and we have included a sample form for evaluating such reports in the Teacher Comment Section. Visual work is called for more frequently throughout the learning activities, therefore we have suggested some guidelines for scoring this type of effort in the Teacher Comment Section. These two forms could be easily modified for any local situation. The range of written assignments requested is so great that the evaluation of this area is left completely up to the teacher. Whatever methods for evaluating oral, visual, and written assignments are applied should be carefully explained to students before beginning the unit of study.

ACKNOWLEDGEMENT

This Project would have been impossible without the efforts and cooperation of the classroom teachers who helped develop, test, and revise these environmental learning units. The assistance given by Dr. Edwin Shirkey, of Florida Technological University in Orlando, Florida, to evaluate the students' performance outcomes was invaluable. Students participating in all the Pilot Classes made many constructive suggestions for revising the learning units.

Special mention goes to those teachers who performed extra tasks. David MacDonald and June Schmidlkofer were instrumental in writing A Suggested Model for Student-Directed Class Discussion and parts of the section on evaluating student performance. Eric Johnson, Robert Findlay and JoAnn Stringer acted as the revision committee, making the changes that made this final product possible. Nina Belle Fritz, Ellen Claussen and Linda Lincoln spent hours drawing up a package of material that would explain to teachers how they could use Man's Impact on the Environment.

My greatest appreciation is extended to all of these individuals.

Roger L. Henry
Chairman

LOOKING AHEAD

Looking Ahead is a feature provided for those teachers who wish to be prepared for the learning activities by securing the needed resources not supplied within this package before it is time to use them.

Looking Ahead at the Barrier Beach

	Resource Needed	Place Used (Page Number)
1.	Filmstrip: Keys to Basic Ecology	3
2.	Dictionaries, encyclopedias, science textbooks	6
3.	Atlases, encyclopedias, reference textbooks, wall maps	11
4.	Maps of local area	12
5.	Library time: Vertical file	17
6.	Film: Treasure Island	23
7.	List of Major Land Developers	25

A MODEL FOR INVESTIGATING CHANGE IN ECOSYSTEMS

An Inquiry Study

I. What is an ecosystem?

II. What is a description of the ecosystem being investigated?

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

IV. Where are some specific locations of the ecosystem being investigated?

V. What biotic and abiotic features in the ecosystem have changed and are undergoing change?

VI. What are the natural factors causing change in the ecosystem and how have they been brought about?

VII. What are the man-made factors causing change in the ecosystem and how have they been brought about?

VIII. What are the results of the changes?

A. Beneficial?
B. Detrimental?

IX. What, if any, new changes are needed in the ecosystem?

X. How might these needed changes to the ecosystem be brought about?

LEARNING ACTIVITIES

Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1:			
A. INTRODUCE 1. Write this question on chalkboard: "What is an ecosystem?" 2. Tell class they are going to: a. Observe an ecosystem. b. Record all they see or sense in their observations. c. Predict a definition of ecosystem.	A. INTRODUCE	A. INTRODUCE	A. INTRODUCE 1. This Investigation will lead students to define ecosystem. 2. The school grounds will serve as an adequate ecosystem for observation.
B. OBSERVE 1. Divide class into small groups. 2. Take groups outside on school grounds and deploy at various sites. 3. Tell all groups to record all they see and sense in their surroundings.	B. OBSERVE	B. OBSERVE	B. OBSERVE
C. PREDICT/DISCUSS 1. Using their recorded observations, have each group develop a predicted definition of ecosystem. 2. Have each group report its definition to the class and through discussion, reach a consensus on the meaning of ecosystem.	C. PREDICT/ DISCUSS	C. PREDICT/ DISCUSS Collect written copies of definitions and check.	C. PREDICT/DISCUSS 1. At this time, do not make any comment on whether or not the definition is correct. 2. Record consensus on chalkboard.

Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
D. VIEW 1. Tell the class they are going to: a. View a sound filmstrip. b. Compare their definition of ecosystem with what they see and hear. c. Revise their class definition if necessary. 2. Show filmstrip on ecology.	D. VIEW 1. Keys to Basic Ecology "Interrelationship Set" Filmstrip #1 - Ecosystem. 2. Order from: Olin Educational Services, 460 Park Ave., New York, N. Y. 10022.	D. VIEW	D. VIEW 1. An alternate filmstrip that could be used: a. Our Environment: Problem or Promise, Filmstrip #211 - "Ecology: The Web of Nature." b. Order from: A. J. Nystrom and Co., 3333 Elston Ave., Chicago, Illinois 60618. 2. Any local visual-aid that shows the definition of an ecosystem can be used.
E. DISCUSS 1. Through class discussion, revise predicted class definition if needed. 2. Familiarize students with the meaning of biotic and abiotic, as they relate to the definition of ecosystem. These words will be used throughout the unit of study.	E. DISCUSS	E. DISCUSS	E. DISCUSS 1. One definition of ecosystem -- "a system in which the biotic (living) and abiotic (non-living) features are in constant interaction." 2. Meanings: Biotic means all things living or recently living. Abiotic means all things non-living. Bio- from the Greek, bios, meaning life. A- from the Greek, meaning not.

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Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
			3. TC # 1 , p. 100, will help in a detailed discussion of what is considered living and not living.
F. OBSERVE 1. Divide class into small groups. 2. Tell students they are going to: a. Check their new definition with the ecosystem they first observed. b. List specific examples of: (1) biotic/abiotic features they observe (2) relationships among those features. 3. Take students back out to school grounds.	F. OBSERVE	F. OBSERVE Collect list of observations.	F. OBSERVE Remind students to carry a revised definition with them to the school grounds.
G. DIAGRAM Have each group work together using observation lists and produce one diagram which illustrates the various interdependent relationships among the biotic and abiotic.	G. DIAGRAM	G. DIAGRAM Collect diagrams and check.	G. DIAGRAM 1. Suggest that arrows (⟶) could be used to show relationships. 2. This could be an individual assignment and worked on at home.

Inquiry Question:

I. What is an ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
H. CHECK I. Q. Have students check results of their small group work.	H. CHECK I. Q.	H. CHECK I. Q. SC #1, p. 32. (I. Q. Check)	H. CHECK I. Q. TC #2, p. 101, gives procedure for this check.
I. EVALUATE SELF Have students evaluate themselves.	I. EVALUATE SELF	I. EVALUATE SELF SC #2, p. 33.	I. EVALUATE SELF If Individual Point Sheets (I. P. S.) are to be used, reproduce sample form on page xiii of the Foreword and distribute to students.

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Inquiry Question:

II. What is a description of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1:			
A. VIEW/DISCUSS 1. Divide class into small groups. 2. Have each group view SC #'s 3-6 and then develop a written description of a barrier beach. 3. Place each group's definition on chalkboard.	A. VIEW/DISCUSS Student Comment (SC) #'s 3-6, pp. 34-37.	A. VIEW/DISCUSS 1. Collect each group's description and evaluate contents. 2. Allow one class to compare description with other classes working on the same assignment.	A. VIEW/DISCUSS 1. Place Inquiry Question on chalkboard. 2. See Foreword, page number xv, for setting up small group discussion. 3. TC #3, p. 102, gives some background to the formation of a barrier beach.
B. DECIDE Through class discussion, decide on one description.	B. DECIDE	B. DECIDE Use TC #4, p. 103.	B. DECIDE See Foreword, page xiv, for setting up large group discussion.
C. READ/COMPARE 1. Have students read SC #7 and other sources for a description of barrier beach. 2. Have students compare their class' description to the ones found in SC #7 and other sources. 3. Through class discussion have students make any necessary changes in their description.	C. READ/COMPARE 1. SC #7, p. 38. 2. Dictionaries, encyclopedias, science text books.	C. READ/COMPARE Use TC #4, p. 103.	C. READ/COMPARE

Inquiry Question: II. What is a description of the ecosystem being investigated?			
Learning Activities	**Resources**	**Evaluation**	**Teacher Suggestions**
Investigation #2: A. DISCUSS 1. Divide class into small groups. 2. Have each group discuss and note the general nature of beaches including these ideas: -- composition -- topography (structure of the beach)	A. DISCUSS	A. DISCUSS	A. DISCUSS
B. REPORT 1. Each group reports to class its description of the beach. 2. Have class discuss all reports and reach a consensus description.	B. REPORT	B. REPORT	B. REPORT Record of description should be kept for future review.
C. READ/REVISE 1. Have each student read SC #8. 2. Have class revise its description of the beach if necessary.	C. READ/REVISE SC #8, p. 39.	C. READ/REVISE	C. READ/REVISE Emphasis should be placed on the importance of the fourth zone which includes the dune line.
D. DIAGRAM 1. Have each student diagram the beach, showing the four major zones. 2. Allow students to review SC #8, if necessary.	D. DIAGRAM SC #8, p. 39.	D. DIAGRAM Collect diagrams and evaluate.	D. DIAGRAM

Inquiry Question:

II. What is a description of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
E. CHECK I. Q. Have students check results of their small group work.	E. CHECK I. Q.	E. CHECK I. Q. SC #1, p. 32.	E. CHECK I. Q. TC #2, p. 101, gives procedure for this check.
F. EVALUATE SELF Have students evaluate themselves.	F. EVALUATE SELF	F. EVALUATE SELF SC #2, p. 33.	F. EVALUATE SELF

Inquiry Question:

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1 A. VIEW/LIST 1. Divide class into small groups. 2. Have each group view slides #1-10 and list all biotic and abiotic features seen. List in two separate columns: Column A - Abiotic Column B - Biotic B. REVIEW 1. Have groups exchange lists and check that each item is properly categorized. 2. Have class discussion on any questionable items and then make one master list (Columns A and B) for entire class.	A. VIEW/LIST Slides #1-10, p.108. B. REVIEW	A. VIEW/LIST B. REVIEW TC #4, p.103.	A. VIEW/LIST 1. Additional films showing biotic and abiotic relationships on the barrier beach may supplement this section. a. One possibility is "Succession--Sand Dune to Forest." b. This film is #8-297 in the Brevard County Film Library. 2. Read for background data: The Life of the Seashore, William Amos, McGraw-Hill, Inc., New York, 1966, pp. 66-70. B. REVIEW 1. Encourage students to back up changes with reasons. 2. Place final master list on chalkboard.

Inquiry Question:

III. What are some of the biotic and abiotic features of the ecosystem and how do these features interrelate?

Learning Activities	Resources	Evaluation	Teacher Suggestions
C. DIAGRAM/EXPLAIN 1. Have each group select an item from Column A and Column B and realistically relate the two by diagramming the relationship between the abiotic and biotic features. 2. Make a short written explanation of how and why organisms relate to their abiotic environment.	C. DIAGRAM/ EXPLAIN	C. DIAGRAM/ EXPLAIN 1. Have groups exchange diagrams and explanations to review and question. 2. Collect diagrams and written explanations for evaluation.	C. DIAGRAM/EXPLAIN 1. Remind students of the definition of ecosystem. 2. A series of these correlations may better show the student the interrelationship of biotic and abiotic features.
D. DEMONSTRATE/DISCUSS 1. One student from each group illustrates on the chalkboard a relationship found in the barrier beach. 2. Through discussion of illustration, guide students to an understanding of biotic/abiotic relationships.	D. DEMONSTRATE/ DISCUSS	D. DEMONSTRATE/ DISCUSS TC #4, p. 103.	D. DEMONSTRATE/DISCUSS
E. CHECK I. Q. Have students check results of their small group work.	E. CHECK I.Q.	E. CHECK I. Q. SC# 1 , p. 32.	E. CHECK I.Q. TC# 2 , p. 101. gives procedure for this check.
F. EVALUATE SELF Have students evaluate themselves.	F. EVALUATE SELF	F. EVALUATE SELF SC# 2 , p. 33.	F. EVALUATE SELF

Inquiry Question:

IV. Where are some specific locations of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1: A. READ Have students read SC #9 and note locations of various barrier beaches. B. LOCATE 1. Divide students into small groups and allow each group to select one of the following states to investigate: --Florida --Louisiana --New Jersey --New York --North Carolina --Texas 2. Have each group sketch the outline of their state and locate examples of barrier beaches. 3. Label appropriate bodies of water, land masses and major cities which aid in describing the location of barrier beaches. C. VIEW Place evaluated and corrected maps on bulletin board and allow class to look over them for barrier beaches found in other states.	A. READ SC #9, p. 40. B. LOCATE 1. Atlases, encyclopedias, reference textbooks, wall maps. 2. Roadmaps from local service stations are good sources of information. (If not available try Chamber of Commerce.) C. VIEW	A. READ B. LOCATE Collect maps and evaluate. C. VIEW	A. READ B. LOCATE Return any maps in error and ask for corrections. C. VIEW This activity of reviewing maps can also be done by simply circulating completed sketches among the small groups.

Inquiry Question:

IV. Where are some specific locations of the ecosystem being investigated?

Learning Activities	Resources	Evaluation	Teacher Suggestions
D. LOCATE 1. Make another bulletin board. Display and show maps of the Brevard County area. 2. Have each student view the bulletin board and then locate and label barrier beaches on the outline map of Brevard County (SC #10). 3. Mark bodies of water, land masses, and major cities which aid in describing the location of the barrier beach.	D. LOCATE 1. Chambers of Commerce and service stations can provide maps. 2. SC #10, p. 41.	D. LOCATE Collect all maps and evaluate.	D. LOCATE 1. Reference to these maps may be made as later SC's are read. 2. If possible and desirable, take a field trip to one of the local barrier beach locations.
E. CHECK I. Q. Have students check results of their small group work.	E. CHECK I. Q.	E. CHECK I. Q. SC #1, p. 32.	E. CHECK I. Q. TC #2, p. 101, gives procedure for this check.
F. EVALUATE SELF Have students evaluate themselves.	F. EVALUATE SELF	F. EVALUATE SELF SC #2, p. 33.	F. EVALUATE SELF

Inquiry Question:

V. What biotic and abiotic features in the ecosystem have changed and are undergoing change?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1 A. VIEW/COMPARE 1. Divide class into small groups. 2. Have all groups view slides 11-20. 3. Have students view SC's #'s 11-15 (pictures). 4. Have students compare the visual shots of Brevard beaches and note any differences or changes that appeared to have occurred over the years. B. DISCUSS In small groups, have students discuss and list the abiotic and biotic changes that most likely took place between time periods. C. READ/RESEARCH/LIST 1. Have groups read one of the SC #'s 16-18 and list what biotic and abiotic changes the readings are suggesting that take place on the barrier beach. 2. Arrange time in library for students to find other biotic/abiotic changes occurring on the beach. 3. Have each group list all these changes.	A. VIEW/COMPARE 1. Slides 11-20, p.109. 2. SC #'s 11-15, pp. 42-46. B. DISCUSS C. READ/RESEARCH/LIST SC #16-18, pp. 47-49.	A. VIEW/COMPARE B. DISCUSS Collect lists and evaluate. C. READ/RESEARCH/LIST Collect copy of lists and evaluate.	A. VIEW/COMPARE 1. TC #5, p.104, gives probable changes and causes for the conditions shown in the slides. 2. Copies could be shown on bulletin board or individual copies could be passed around groups. B. DISCUSS C. READ/RESEARCH/LIST 1. Stress that articles are being read to find biotic/abiotic changes. 2. One magazine article that may help is: "As the Seashore Shifts," Science News, June 17, 1972, pp. 396-7.

Inquiry Question:

V. What biotic and abiotic features in the ecosystem have changed and are undergoing change?

Learning Activities	Resources	Evaluation	Teacher Suggestions
D. DISCUSS In large group discussion, have students decide on a general answer to the Inquiry Question by using the lists they compiled in activities B and C.	D. DISCUSS	D. DISCUSS TC #4, p. 103.	D. DISCUSS
E. CHECK I.Q. Have students check results	E. CHECK I.Q.	E. CHECK I.Q. SC# 1, p. 32.	E. CHECK I. Q. TC# 2, p. 101, gives procedure for this check.
F. EVALUATE SELF Have students evaluate themselves.	F. EVALUATE SELF	F. EVALUATE SELF SC# 2, p. 33.	F. EVALUATE SELF

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Inquiry Question:

VI. What are the natural factors causing change in the ecosystem and how have they been brought about?

VII. What are the man-made factors causing change in the ecosystem and how have they been brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1:			
A. REVIEW Have small groups review slides 11-20 and SC #'s 11-15 again.	A. REVIEW 1. Slides 11-20, p. 109. 2. SC #'s 10-14, pp. 42-46.	A. REVIEW	A. REVIEW 1. Slides 11-20 and pictures are selected shots of Brevard's barrier beach. 2. Stress that students are now looking for factors that cause change and how the change happened.
B. DISCUSS/LIST Have students discuss and list apparent causes (natural and man-made) for the changes noted in the previous Investigation.	B. DISCUSS/LIST	B. DISCUSS/LIST Collect and evaluate lists of causes.	B. DISCUSS/LIST
C. SCAN/LIST 1. Students should scan SC #'s 16-18 again. 2. Students will discuss and list apparent causes (natural and man-made) for the changes noted in the previous Investigation.	C. SCAN/LIST SC #'s 16-18, pp. 47-49.	C. SCAN/LIST	C. SCAN/LIST
D. DISCUSS 1. In large group discussion, have students decide on a general answer to what natural and man-made causes have brought about change. 2. Students should then answer: What natural factor is the one major cause of change on the barrier beach?	D. DISCUSS	D. DISCUSS	D. DISCUSS Undoubtedly students will recognize erosion as the major phenomenon causing change on the barrier beach.

Inquiry Question:
VI. What are the natural factors causing change in the ecosystem and how have they been brought about?
VII. What are the man-made factors causing change in the ecosystem and how have they been brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
E. READ Students should read SC #19 and in small groups, write answers to these two questions: -- How does nature cause erosion? -- How does man cause erosion?	E. READ SC #19, p. 51.	E. READ	E. READ
F. DISCUSS Have each group read answers to class and then decide on a consensus.	F. DISCUSS	F. DISCUSS TC #4, p. 103.	F. DISCUSS List consensus on chalkboard.
G. CHECK I. Q. Have students check results of their small group work.	G. CHECK I. Q.	G. CHECK I. Q. SC # 1, p. 32.	G. CHECK I. Q. TC #2, p. 101, gives procedure for this check.
H. EVALUATE SELF Have students evaluate themselves.	H. EVALUATE SELF	H. EVALUATE SELF SC #2, p. 33.	H. EVALUATE SELF

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Inquiry Question: VIII. What are the results of the changes? A. Beneficial? B. Detrimental?			
Learning Activities	**Resources**	**Evaluation**	**Teacher Suggestions**
Investigation #1: "County Commission" - A Simulation.			
A. PREPARE 1. Have students read: a. SC #20 for an overview of the simulation. b. SC #21 for background on Resolution 1. 2. Have students review SC #22 and choose which community role they would like to play.	A. PREPARE 1. SC #20, p. 54. 2. SC #21, p. 54-A. 3. SC #22, p. 55.	A. PREPARE	A. PREPARE 1. "County Commission" is a simulation devised to have students review, debate, and decide on mock resolutions dealing with the detrimental and beneficial uses of the barrier beach environment. 2. Add any roles necessary to represent a cross section of your local community.
B. PLAN 1. Have students make plans to interview a person who closely resembles the role they have chosen to play. Questions like the ones in SC #23 should be asked by the interviewer. 2. Allow time for students to research the issues. a. Review library materials. b. Collect current news articles on similar subjects. 3. Outline reasons and evidence for position on resolutions.	B. PLAN 1. SC #23, p. 56. 2. Vertical file of news clippings.	B. PLAN Individual lists of reasons and evidence could be collected and evaluated.	B. PLAN 1. Interviews should be conducted after school hours. 2. SC #23 contains only suggested questions; allow students to compose questions they desire. 3. Encourage students to talk with people they know personally. 4. If students wish, after reasons have been outlined, allow them to form groups of similar interest and plan group action for county commissioner's meeting.

Inquiry Question: VIII. What are the results of the changes? A. Beneficial? B. Detrimental?			
Learning Activities	**Resources**	**Evaluation**	**Teacher Suggestions**
C. PLAY 1. Have chairman of the County Commission call the meeting to order, read the resolution and call on each commissioner for an initial position statement. 2. Next, each citizen, or citizen's group will give its position and reasons on the resolution. 3. Following the citizen presentations, the commissioners will discuss the evidence presented, list advantages/disadvantages on the chalkboard, and take a final vote on the resolution.	C. PLAY	C. PLAY Evaluate all "players" on their presentations.	C. PLAY 1. Arrange classroom to simulate a public hearing before the county commission. 2. Deliberations of the commissioner should be done in front of the entire class.

Inquiry Question: VIII. What are the results of the changes? A. Beneficial? B. Detrimental?			
Learning Activities	**Resources**	**Evaluation**	**Teacher Suggestions**
Investigation #2: A. READ 1. Have students read SC #24 and note the purpose for building "jetties." 2. Read SC #25 and note the particular effects of jetties on Port Canaveral. 3. Read SC #26 to see economic importance of Port Canaveral (Florida). 4. Study carefully SC #27, and note the problems and apparent causes presented in the Applegate Case.	A. READ 1. SC #24, p. 57. 2. SC #25, p. 58. 3. SC #26, p. 59. 4. SC #27, p. 60.	A. READ	A. READ Students may wish to contact Today newspaper for action taken on the Applegate Case after May 6, 1973. Today Newspaper 308 Forrest Avenue Cocoa, Florida 32922
B. LIST 1. Divide class into small groups. 2. Ask each group to list the advantages/disadvantages of building jetties for a port like Port Canaveral.	B. LIST	B. LIST Collect and evaluate lists.	B. LIST
C. DISCUSS In class discussion, have a group representative give its list and discuss good/bad points of jetties. Talk about specific problems of the Applegate Case (SC #27).	C. DISCUSS	C. DISCUSS TC #4, p. 103.	C. DISCUSS
D. LIST List on chalkboard any consensus reached.	D. LIST	D. LIST	D. LIST

Inquiry Question: VIII. What are the results of the changes? A. Beneficial? B. Detrimental?			
Learning Activities	**Resources**	**Evaluation**	**Teacher Suggestions**
E. CHECK I. Q. Have students check results of their small group work.	E. CHECK I. Q.	E. CHECK I. Q. SC #1, p. 32.	E. CHECK I. Q. TC #2, p. 101, gives procedure for this check.
F. EVALUATE SELF Have students evaluate themselves.	F. EVALUATE SELF	F. EVALUATE SELF SC #2, p. 33.	F. EVALUATE SELF

Inquiry Question:

IX. What, if any, new changes are needed in the ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1:			
A. READ 1. Divide class into small groups. 2. Have all students read SC #28. 3. Have each student read any one of the following: a. SC #29 b. SC #30 c. SC #31 d. SC #32 e. SC #33	A. READ 1. SC #28, p. 65. 2. SC #29-33, pp. 70-87.	A. READ	A. READ
B. DISCUSS 1. Have students discuss and describe the various articles read. 2. List any additional ideas for reducing destruction to the barrier beach.	B. DISCUSS	B. DISCUSS	B. DISCUSS Encourage students to be creative and thoughtful when proposing ways to reduce beach destruction.
C. ILLUSTRATE 1. Have students select at least one way of controlling beach damage to illustrate. 2. Students may make simple sketches, collect magazine/newspaper pictures, or take photographs of local examples.	C. ILLUSTRATE	C. ILLUSTRATE 1. Collect illustrations for evaluation. 2. SC #34, p. 91.	C. ILLUSTRATE Illustrations could be used for a bulletin board display.

Inquiry Question:

IX. What, if any, new changes are needed in the ecosystem?

Learning Activities	Resources	Evaluation	Teacher Suggestions
D. PLAN/PRESENT 1. If students come up with unusual and provocative suggestions, allow them to make plans for a presentation to the entire class. 2. Photographic feats may also be presented.	D. PLAN/PRESENT	D. PLAN/PRESENT	D. PLAN/PRESENT
E. DISCUSS 1. In class discussion, have students consider the following: -What methods of erosion control do you think would be best for the local barrier beach? -Why? 2. Record any consensus on the chalkboard.	E. DISCUSS	E. DISCUSS TC #4, p.103.	E. DISCUSS Ask students to consider the ecological, political, and social facets to their suggestions.
F. CHECK I. Q. Have students check results of their small group work.	F. CHECK I.Q.	F. CHECK I.Q. SC#1, p. 32.	F. CHECK I.Q. TC#2, p. 101, gives procedure for this check.
G. EVALUATE SELF Have students evaluate themselves.	G. EVALUATE SELF	G. EVALUATE SELF SC#2, p. 33.	G. EVALUATE SELF

Inquiry Question:

X. How might these needed changes to the ecosystem be brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #1:			
A. READ/DIAGRAM Have students read SC #35 and then diagram the major steps through which the Corps of Engineers go to develop a beach restoration project.	A. READ/DIAGRAM SC #35, p. 92.	A. READ/DIAGRAM Collect diagrams and evaluate.	A. READ/DIAGRAM TC #6, p. 106, shows the major steps for developing a Corps of Engineers beach restoration project.
B. SHOW FILM/DISCUSS 1. Show students the film Treasure Island. 2. Discuss methods used to restore beach.	B. SHOW FILM/ DISCUSS 1. To borrow film, write to Army Corps of Engineers, Public Affairs Office, P. O. Box 4970, Jacksonville, FL 32201. 2. Treasure Island is loaned free of charge.	B. SHOW FILM/ DISCUSS	B. SHOW FILM/DISCUSS Film is in color and running time is about eight (8) minutes.
C. READ/ANSWER 1. Divide class into small groups. 2. Have students read SC #36 and answer the following questions: -- What is the California method of controlling any future changes in its coastline region? -- How extensive an area will the California plan cover? -- To whom will the California plan apply?	C. READ/ANSWER SC #36, p. 95.	C. READ/ANSWER If written answers are required, collect and evaluate.	C. READ/ANSWER Look for news articles dealing with other states and their land use planning. Offer these articles to students as additional efforts for controlling coastline development.

Inquiry Question:
X. How might these needed changes to the ecosystem be brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
-- What evidence is there to show this California effort is supported by the residents of that state? -- What arguments can be made for both sides in the public vs. private rights issue of the state controlled coast development?			
D. DISCUSS In class discussion, consider each group's answers to the questions. Special emphasis should be placed on the last question.	D. DISCUSS	D. DISCUSS TC #4, p. 103.	D. DISCUSS Stress the problems of balance between public and private use of beach areas.
E. READ/DISCUSS Have students read SC #37 and discuss in class the following question: - How does this local governmental agency (Ponce Inlet Port Authority) plan to solve their local erosion problem?	E. READ/DISCUSS SC #37, p. 96.	E. READ/DISCUSS TC #4, p. 103.	E. READ/DISCUSS 1. Data on beach erosion control in Brevard may be obtained from the following: Robert P. Murkshe 961 S. Brevard Avenue Cocoa Beach, FL Mr. Murkshe serves on the Beach Erosion Control Advisory Committee for the Brevard County Commission. 2. To end discussion, remind students these were only governmental approaches to problem erosion.

Inquiry Question:

X. How might these needed changes to the ecosystem be brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
F. WRITE/DISCUSS 1. Have a small committee of students write to major land developers inquiring into their ecological considerations made when building in beach areas. 2. SC #38 gives some sample questions relating to ecological considerations. 3. Students read and discuss replies from these developers.	F. WRITE/DISCUSS 1. SC #38, page 97. 2. Major developers in Florida include the following: -- Amelia Island Plantation, Amelia Island, FL 32034 -- Arvida Corp., 1st National Bank Building, Miami, FL 33131 -- General Development Corp., 1111 S. Bayshore, Miami, FL 33131 -- Mackle Brothers, Division of Deltona, 3250 S. W. 3rd Ave., Miami, FL 33130	F. WRITE/DISCUSS	F. WRITE/DISCUSS Teacher Suggestion — This Activity is an attempt to show how private business can bring about changes in the ecosystem.

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Inquiry Question:

X. How might these needed changes to the ecosystem be brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
G. INVITE 1. If responses to letters to developers take too long, invite a local developer or his representative to speak to the class. 2. USE SC #38 as the basis for developer's talk. Supply him with copy before the speaking engagement.	G. INVITE SC #38, p. 97.	G. INVITE	G. INVITE
H. SUMMARIZE In class discussion, have students make a summary statement that will answer the Inquiry Question.	H. SUMMARIZE	H. SUMMARIZE TC #4, p. 103.	H. SUMMARIZE

Inquiry Question:

X. How might these needed changes to the ecosystem be brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
Investigation #2: A. READ/DISCUSS 1. Divide class into small groups. 2. Have students read SC #39 and discuss the following questions: -- What did the public do? -- What might be some reasons for what they did? -- What are possible harmful results from what the voters did?	A. READ/DISCUSS SC #39, p. 98.	A. READ/DISCUSS	A. READ/DISCUSS
B. PLAN 1. Pretend another referendum for a beach erosion control tax will be held in two months. 2. Make plans for convincing people to vote either for or against the tax. 3. Possible activities include: -- Making posters -- Writing speeches -- Writing bumper stickers -- Writing radio-television announcements -- Creating billboards -- Mapping out a door-to-door canvassing route and questions	B. PLAN	B. PLAN 1. All plans could be collected and evaluated. 2. SC #34, p. 91.	B. PLAN If interest seems to be high and it appears feasible, go beyond the classroom to conduct this mock referendum.

Inquiry Question:

X. How might these needed changes to the ecosystem be brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
C. PRESENT/DISCUSS 1. Each group or individual will present his "campaign contribution" to the class and display if possible. 2. Discuss any conflicting issues as they arise.	C. PRESENT/DISCUSS	C. PRESENT/DISCUSS TC #4, p. 103.	C. PRESENT/DISCUSS
D. VOTE 1. Take a class vote on the beach erosion control tax. 2. Analyze the results of the vote.	D. VOTE	D. VOTE	D. VOTE
E. DISCUSS/LIST In small groups, discuss other ways individuals/groups may be involved in bringing about needed changes to help save the beaches and list the suggestions.	E. DISCUSS/LIST	E. DISCUSS/LIST Lists may be collected and evaluated.	E. DISCUSS/LIST
F. SUMMARIZE Have each group report to class their list and have class make a summary statement on bringing about changes as it relates to the Inquiry Question.	F. SUMMARIZE	F. SUMMARIZE TC #4, p. 103.	F. SUMMARIZE

Inquiry Question:

X. How might these needed changes to the ecosystem be brought about?

Learning Activities	Resources	Evaluation	Teacher Suggestions
G. CHECK I. Q. Have students check results of their small group work.	G. CHECK I.Q.	G. CHECK I.Q. SC# 1, p. 32.	G. CHECK I.Q. TC# 2, p. 101, gives procedure for this check.
H. EVALUATE SELF Have students evaluate themselves.	H. EVALUATE SELF	H. EVALUATE SELF SC#2, p. 33.	H. EVALUATE SELF

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Inquiry Question:

A SUMMARY INVESTIGATION

Learning Activities	Resources	Evaluation	Teacher Suggestions
ALTERNATE CLOSING TO THIS UNIT			
A. SET UP Set up mock hearings before a State Environmental Resources Board. This Board will consider the issues of developing virgin barrier beach areas into some type of project useful to man.	A. SET UP	A. SET UP	A. SET UP Some beach projects: -- housing developments -- recreational areas -- inlets -- fishing piers -- roads over sand dunes
B. PLAN Students choose issues and work in small groups to draw up a plan explaining why selected project is needed or not needed.	B. PLAN Use knowledge learned from all earlier investigations.	B. PLAN	B. PLAN
C. PRESENT 1. Each group presents view to Board and orally justifies it. 2. Board questions plan.	C. PRESENT	C. PRESENT	C. PRESENT
D. VOTE Entire class votes if project is to be carried out.	D. VOTE	D. VOTE	D. VOTE

STUDENT COMMENTS

STUDENT COMMENT NO. 1 : Small Group Evaluation

I. Q. (INQUIRY QUESTION) CHECK

Name _____ Group Number _____ Class Period _____ Date _____

Inquiry Question
Being Investigated: _____

My Answer to
this Inquiry Question: _____

_____

Important parts of this
Inquiry Question Answer
Left Out: _____

Points Possible for
this Inquiry Question _____

Points Awarded for
this Inquiry Question _____

Name of Checker _____

STUDENT COMMENT NO. 2 : Self-Evaluation

SELF-EVALUATION FORM

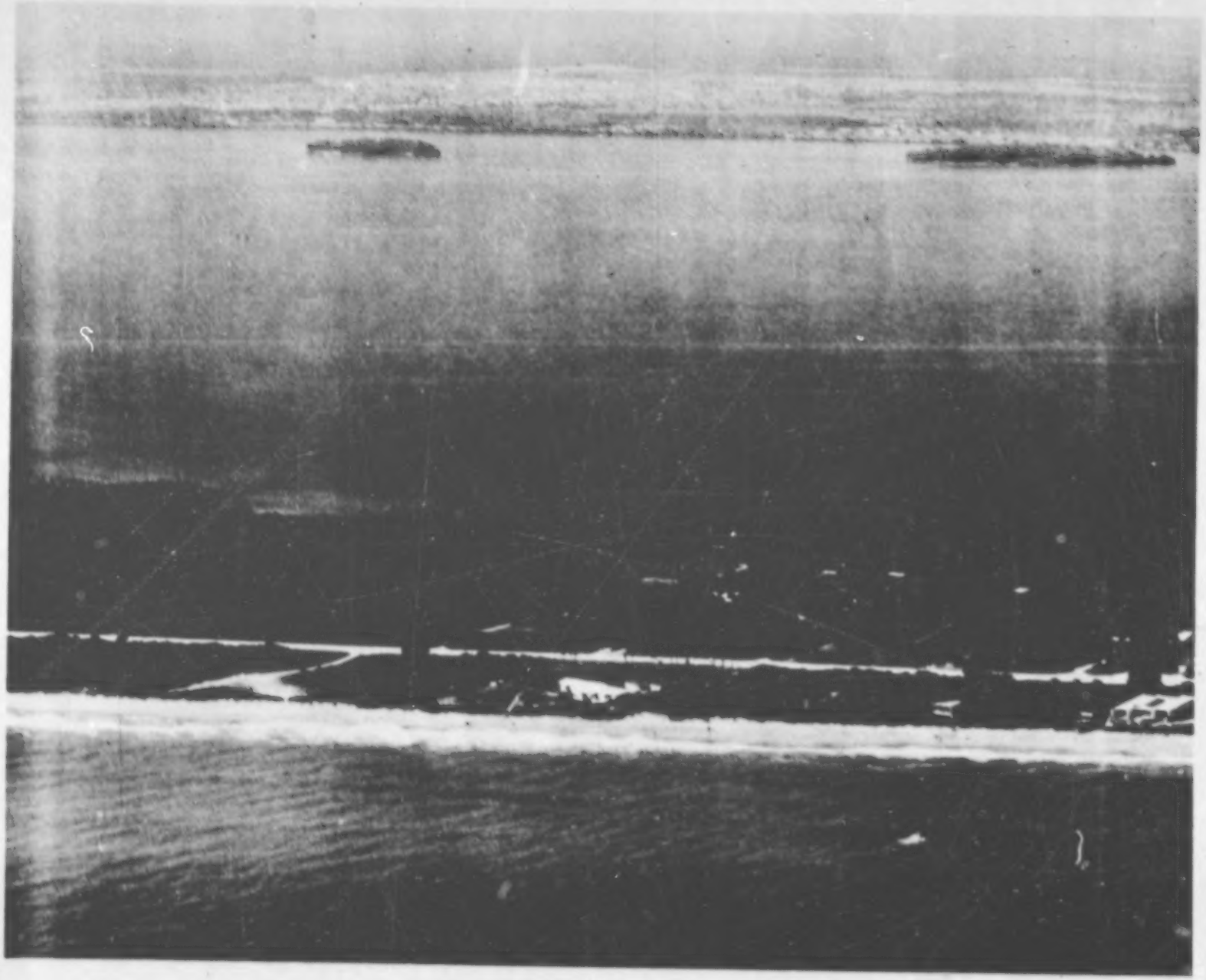
Name_____ Period_____ Date_____

Directions: When you have completed all work on an Inquiry Question, use the Point Scale below and rate yourself on each of the categories listed in the chart.

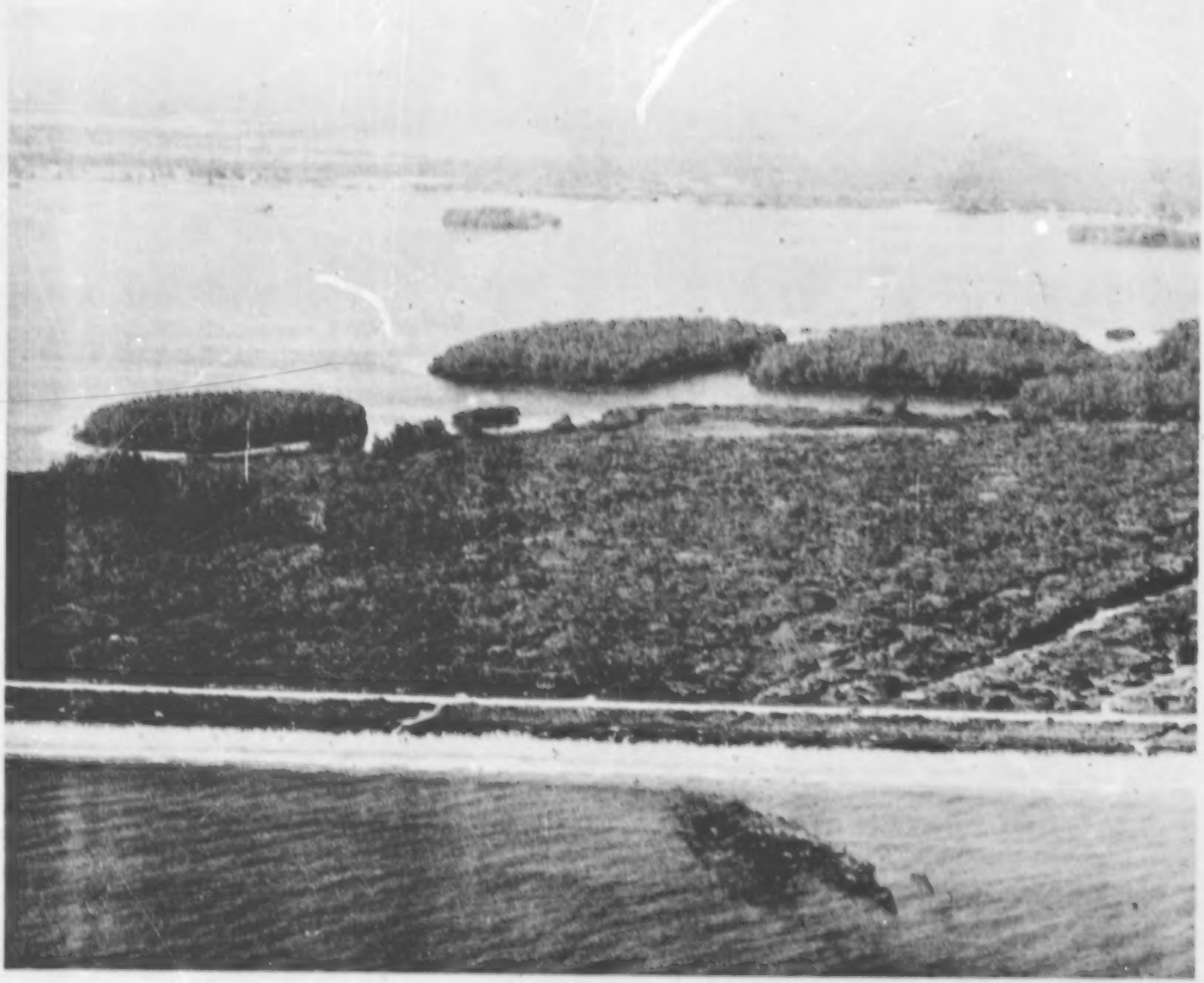
Point Scale: 5 points – excellent; 4 points – above average; 3 points – average; 2 points – below average; 1 point – poor

CATEGORIES	INQUIRY QUESTION NUMBERS									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Interest (To what degree were you interested in this Inquiry Question?)										
Understanding (To what degree do you feel you understand the conclusion to the Inquiry Question?)										
Effort (To what degree did you do all activities to the best of your ability?)										
Cooperative Participation (To what degree did you contribute useful ideas in solving group problems and/or help others reach a conclusion about this Inquiry Question?)										
Total Points										

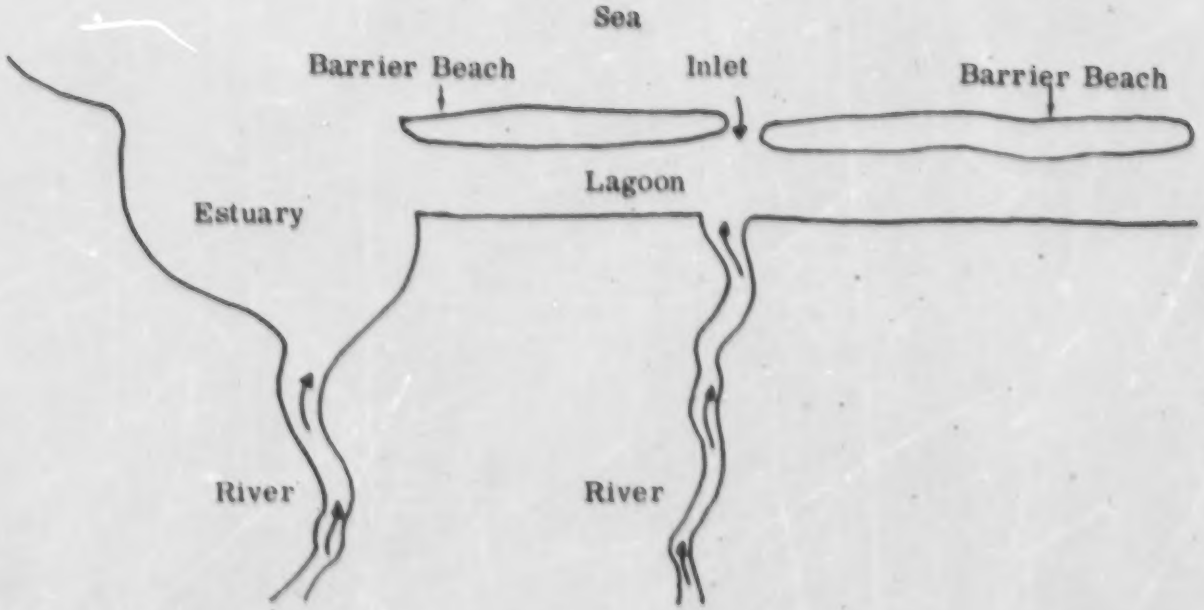
STUDENT COMMENT NO. 3: View of a Barrier Beach



STUDENT COMMENT NO. 4: View of a Barrier Beach



STUDENT COMMENT NO. 5 : Diagram of Barrier Beach



STUDENT COMMENT NO. 6 : Diagram of Offshore Bar (Barrier Beach)

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STUDENT COMMENT NO. 7: Possible Descriptions of Barrier Beach

(1) A barrier beach, often referred to as an offshore bar, is a long, ridge parallel to the shore and separated from it by a shallow lagoon. These bars are formed in front of the line of breakers where the waves break in shallow water some distance from shore. These are common along the Atlantic coast (Daytona Beach, Cocoa Beach, Cape Canaveral, etc.). Breakers pile up the sand offshore on the shallow, sandy bottom and form long sand bars.

--Thompson, Henry D., Fundamentals of Earth Science, Appleton-Century-Crofts, Inc., N.Y., 1960, p. 258.

(2) An offshore bar or barrier beach is a sand bar that runs parallel to a straight shoreline and is nowhere attached to it. . . . An offshore bar protects the shallow water on its landward side from wind and waves. This area of quiet water between the bar and the mainland is a lagoon.

--Namowitz, Samuel N., Donald B. Stone, Earth Science: The World We Live In, American Book Company, N.Y., 1969, p. 312-313, 650.

(3) An offshore sand bar which has been built up by wave action depositing sand to a height above mean sea level.

--Ramsey, William L., Raymond A. Buckley, Clifford R. Phillips, Frank M. Watenpaugh, Modern Earth Science, Holt, Rinehart and Winston, Inc., N.Y., 1973.

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STUDENT COMMENT NO. 8: What Determines the Nature of Beaches?

The first factor to consider is the actual composition of the beach: what kind of substance is it made of? Most beaches are composed of sand, varying in texture from very fine to very coarse. There are two major sources of materials on beaches: streams flowing outward from the land, carrying sediment; and the waves and currents of the ocean, which transport sand. The latter force removes sand as well as depositing it. Some beaches are composed of other materials, such as mud or stones. Many beaches in New England, for example, are made up of rather large stones called "shingle" or "gravel." Mud beaches occur only where wave action is very mild, because the turbulence caused by strong wave action would keep the fine mud particles in suspension. Where mud beaches do exist, they are generally covered with marsh grasses.

Another aspect of the beach is its topography: the structure of the land itself. It can be divided into four major zones. First is the offshore zone, or the area under the sea beyond the breaker line. Second is the inshore zone or shoreface, which includes the area from the breaker line to the mean high tide mark. The third zone is the actual beach or shore itself. This is divided into two sub-zones: the foreshore, which does contact water during high tides; and the backshore, which is submerged only during fierce storms. The backshore usually consists of one or more ledges or levels known as berms, separated by beach scarps ("mini-cliffs"). The fourth zone of the beach is the upland, which includes the major bluff or escarpment (dune) that protects the inland region. Grass, and sometimes bushes and trees, grow on dunes, and the dunes become a natural levee against the sea attack. Dunes are the final protection line against the sea, and are also a savings bank for the storage of sand against a stormy day. The dune line is generally threatened only by the most intense storms.

--Department of the Army, Corps of Engineers, Washington, D. C., Shore Protection Guidelines, August, 1971

STUDENT COMMENT NO. 9: Examples of Offshore Bars

There are many examples of offshore bars along the coast of the United States from southern Long Island all the way to Texas. Many of the larger bars in populated areas have become popular bathing resorts, as at Fire Island and Jones Beach in Long Island and Atlantic City in New Jersey. To reach an offshore bar, a lagoon must be crossed, usually by bridges or roads called causeways.

All offshore bars are low and very narrow in comparison with their length. Fire Island is about 30 miles long but nowhere mpre than a mile in width. Its greatest heights are those reached by the tops of its sand dunes --about 30 feet above sea level. One offshore bar, Padre Island, runs a hundred miles along the coast of Texas. Galveston, Palm Beach, Daytona Beach, and Miami Beach are also located on offshore bars.

The lagoon between an offshore bar and the mainland is rarely so named. Examples are Biscayne Bay between Miami Beach and Miami, Lake Worth between Palm Beach and West Palm Beach, Indian River and Banana River between Cape Kennedy and the Florida mainland, and Great South Bay between Fire Island and Long Island, New York. Despite their names, these are all lagoons.

--Namowitz, Samuel N., Donald B. Stone, Earth Science: The World We Live In, American Book Company, NY., 1969, pp. 312-313.

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STUDENT COMMENT NO. 10: Outline Map of Brevard County, Florida

Picture 1. South Side of Canaveral Harbor.

Picture 2. City of Cape Canaveral

Picture 3. Sidney Fisher Park at Cocoa Beach

Picture 4. Cocoa Beach.

Picture 5. Officers Club at Patrick Air Force Base.

Picture 6. Dragline fill at Patrick Air Force Base.

Picture 7. Satellite Beach.

Picture 8. Indialantic Beach.

Picture 9. Melbourne Beach -- Active Erosion

Picture 10. Beach Conditions About 5 Miles South of Melbourne Beach

TODAY, Sunday, January 2, 1972

Editorials TODAY

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Wrecking the Landscape

The high dirt banks along some of Brevard's roads and the sand dunes in many of our wilderness areas have taken on a different appearance during the past year or so from the natural look that had existed for hundreds of years. Many of them are now defaced with ruts and have badly eroded crests.

This is not a natural erosion caused by water or wind. It is a man-made erosion caused by the recent popularity of the "sport" ow dune buggies and other "off-the-road" types of vehicles, including some motorcycle riders.

These sand dune riders get their kicks from the wild ride and challenge of their motorized sport. It is not their intent to injure the land and destroy the beauty of the countryside for others. But this is nevertheless an unfortunate byproduct of their sport.

We generally take a liberal attitude toward any activity that is enjoyed by it's practitioners, as long as it doesn't harm or endanger other members of society.

Although the dune buggie may not offer a direct threat to the health or safety of the public, it does seem a threat to the general welfare in some abstract ways. For the few minutes of pleasure it affords a dune buggy pilot, it leaves an enduring scar on the land that cheats others of the natural beauty of nature. And there may also be some more concrete objections — at least in some beach areas.

"There's no question that they do cause environmental damage," says Rep. A. H. "Gus" Craig, D-St. Augustine, chairman of the House Natural Resources Committee. "As time goes on and you keep getting more of them (dune buggies, etc.) you're going to have to find some place to put these people. I don't think you can do away with them. You have to realize that they're here to stay, but you have to keep it from getting completely out of hand," he said.

Craig's committee will be holding hearings soon on a couple of bills designed to protect the peace and integrity of the great outdoors. One is a bill by Rep. Bill Fulford, D-Orlando, to regulate air boats, and the other is a bill by Rep. Don Tucker, D-Tallahassee, to ban dune buggies from most beaches.

State Recreation and Parks Director Ney Landrum says the problem of dune buggies "is bad enough so that we're trying to take some steps to get it under control."

We agree that some limits and controls should be placed on the indiscriminate use of off-the-road vehicles before our state suffers very much more needless destruction. Restrictions were placed on halftracks and other swamp rigs in game management areas not long ago. These should be expanded and extended to cover other damaging vehicles and lands outside game management areas.

Perhaps there could be some specified areas around the state where this type of activity could be allowed.

We hate to see more and more restrictions placed on the public, but the thoughtless abuse by some dune buggy drivers makes such action seem necessary.

STUDENT COMMENT NO. 16:

STUDENT COMMENT NO. 17: Shifting Sands

A slender ribbon of light-colored sand, about thirty miles long and less than a mile wide, arches gracefully southward from Long Island and pierces the dark blue waters of the Atlantic Ocean. Map makers call it Great South Beach, but to most New Yorkers it is known as Fire Island. Fire Island is the northernmost segment of an almost continuous chain of low barrier islands that extends from New York to Florida. Similar barrier chains line much of the Gulf Coast, the North Sea coast of Holland, and the Baltic Sea Coast of Poland. In the United States a number of important industrial and resort cities -- Galveston, Miami Beach, Atlantic City, to mention three -- have developed on these islands . . .

The geologic processes that shape a barrier island do not change with the arrival of man. The complex coastal processes -- their broad patterns and detailed variations -- are part of an ongoing history of physical change in which neither of the main factors, waves nor beaches, gains a permanent victory. The process of sand transportation within the surf, for example, is a response by the beach to the changing pattern of breaking waves. The problem for man is not the movement of sand as such, but rather its movement away from areas where it is needed for the protection of expensive homes. When the beachfront was unoccupied, the beach could shift without alarming anyone. Now, with the presence of houses and other fixed objects against which shoreline changes can be measured, island dwellers become dismayed by the loss of their sand . . .

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Schuberth, Christopher J., "Barrier Beaches of Eastern America," Natural History, June, July 1970, p. 46.

STUDENT COMMENT NO. 18: Moving Beaches

The distance and the direction that sand grains move are related to the coastal conditions of summer and winter seasons. During the summer, waves are usually low, the surf is not turbulent, and the corresponding swash is a thin sheet of gentle water. Few storms occur. Under these quiet weather conditions, friction will hold sand grains against the bottom during the gentle backflow of water, and most are not carried back in the undertow to the breaker zone. As a result, the net movement of sand is landward. Beginning in early summer, billions of sand grains along the length of the beach slowly build up a broad terrace . . .

Intense winter-spring storms with on-shore winds of gale force often produce high tides and chaotic patterns of breaking waves. A turbulent surf and a powerful swash flood the winter berm and often tear into the dunes, removing tens of thousands of cubic yards of sand . . .

If the sand moved only in a straight line away from the shore in the winter and back in the summer; if in other words, the same sand moved back and forth in a closed system, then beach erosion would be a simple problem. Unfortunately, sand also moves lengthwise along the beach . . .

The sand particles move along the chain because waves rarely approach parallel to the beach . . .

The uprush of water from the breaking wave, plus the sand particles, moves obliquely up the beach face. But the return flow and the sand particles follow a straight path down the beach face. When moved by the next swash, the sand grains follow the same stepwise pattern. Multiplied by countless repetitions on a seemingly infinite number of sand grains, this action transports a vast amount of sand along the entire beach, primarily in the surf zone. This process is called beach drifting, and the movement of water is known as the littoral current.

On Fire Island, in New York, the littoral current each year moves 600,000 cubic yards of sand westward. Most of it remains in the quieter waters of Fire Island Inlet and forms submerged sand bars,

which quickly coalesce into low above water accumulations. This sand persistently extends Democratic Point, the west end of Fire Island. Six hundred thousand cubic yards of sand is equivalent to a convoy of cement trucks dumping loads of sand at nine minute intervals, 24 hours a day, year-round. The Fire Island lighthouse, erected in 1858 at the westernmost tip of the island, now stands five miles inland . . .

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Schuberth, Christopher J., "Barrier Beaches of Eastern America," Natural History, June, July 1970, p. 46.

STUDENT COMMENT NO. 19: Causes of Beach Erosion

One of the primary environmental concerns in Brevard County is the problem of beach erosion. Knowledge of the natural forces which operate upon the beach and the consequences of man's actions in this area is essential if this problem is to be solved.

Beach erosion is essentially a simple mathematical equation: if more material is removed from the beach than is deposited, erosion is said to have occurred. There are several causes of beach erosion, both natural and man-made.

The most important force influencing onshore, offshore and alongshore transportation of sand is the breaking wave, or "breaker." As a wave approaches the shore, it collapses when the depth of water is equal to approximately 1.3 times the height of the wave (e.g., a wave three feet high would break at a depth of about 4 feet). When a wave breaks, it's energy is suddenly unleashed, and the turbulent rush of water stirs up materials on the bottom. The energy is spent as the foaming water surges up the slope into the sea.

Generated by winds at sea, waves affect the beaches in two major ways. Short, steep storm waves tend to tear the beach down; this is known as erosion or shoreline recession. Long swells from distant storms, however, rebuild beaches by depositing sand. This is known as accretion or prograding. Erosion and accretion may occur alternately, according to the intensity and frequency of storms, or by seasons, or even in cycles covering several years.

This force is continually working on the shoreline, but it is generally quite gradual, and of minor importance in the Brevard area.

The second natural form of beach erosion is much more of a threat to Brevard's beaches. This occurs when the waves break at an angle to the beach. Each wave moves some sand particles a little further along the beach. This process is called littoral drift. While the effect of each individual breaker is insignificant, the cumulative effect is substantial. Along an uninterrupted expanse of beach, however, the impact is not noticeable, because roughly as much sand is deposited as is carried off; an equilibrium exists. The direc-

tion and extent of the littoral drift are determined by the direction and violence of the wave attack. It varies considerably in different regions of the country.

In a coast facing eastward, as in Brevard County, storm waves from the northeast cause a high rate of littoral transport to the south. Mild wave action from the southeast, on the other hand, results in a much lesser littoral drift to the north, unless it continues for a much longer time than the northeast waves, in which case there is a net movement of sand in a northerly direction. Although littoral drift varies with the weather, there is usually an overall movement in one direction during the year. In Brevard, the predominant littoral drift is southward. Knowledge of the direction and intensity of littoral drift is important in developing effective shore protection plans.

Hurricanes Wage Berm Warfare

Hurricanes or other violent storms can have an enormous effect on the beaches. The large, steep waves generated by such storms carry off much more sand from the beach than ordinary waves. In addition, the intense winds often create a storm surge which raises the water level enough to threaten the higher parts of the beach which are not usually subject to wave action. Man-made structures situated too close to the water are often demolished, and low-lying areas near the ocean or lagoons and bays are inundated. Storm surges are most devastating if they coincide with high tide. The berm or berms of the beach generally bear the brunt of a violent storm, but they can be overtopped by the steepest waves, exposing the dunes or bluffs in the upland reaches of the beach to a watery assault. Moreover, as the storm waves erode the berm, its protective value is reduced, and increasingly more overtopping results. The width of the berm and the duration of the storm are therefore critical in determining the amount of upland damage the storm can inflict. A gently sloping beach of sufficient height and width is nature's own barrier to hurricanes. No matter how massive the impact of a hurricane, however, the damage to the BEACH itself is repaired by natural means--the erosion is usually replaced by accretion from swells. Man's structures sometimes don't fare as well.

The Sea Is Rising

Another major natural force which affects the beaches is a gradual rise in the level of the sea--approximately 1/100 of a foot per year. This probably results from melting ice in polar regions. The effect of such a rise is far greater than the measurement would indicate; even this vertical rise can cause the shoreline to recede by up to three feet per year. Obviously, such a pattern is highly significant for communities along beach-front areas.

There are other natural forces which contribute to beach erosion: the dissolving of shell material, the pulverizing of beach materials into fine granules which are carried into deeper water, and winds which blow sand inland from the beach. However, these are minor compared to direct wave action, littoral drift, and the rising sea level.

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The chief instance where man contributes to beach erosion is by interrupting the littoral drift. He does this by creating inlets, altering existing inlets, and constructing jetties. While natural inlets are a PARTIAL barrier to littoral drift, improved inlets and man-made inlets can be TOTAL barriers. Long jetties on the north side of inlets can trap nearly all the sand drifting southward. Any sand which leaks through or is washed around the jetty is caught in the deep channel and either remains there until it is dredged out or is washed in and out by tidal currents. The result is dramatic beach erosion on the south side of the inlet, because there is no sand from the north side to replace what is lost to a newly-beginning littoral drift to the southward. Nearly 50% of the sand in the southward littoral drift along the Space Coast is entrapped by natural or man-made obstacles.

"The Behavior of Beaches," Shore Protection Guidelines, Department of the Army Corps of Engineers, Washington, D. C., August, 1971, p. 16-24.

East Central Florida Regional Planning Council Staff, The Coastal Area, Titusville, FL, October 1968, pp. 32-34.

STUDENT COMMENT NO. 20: County Commission -- A Simulation

"County Commission" is an activity in which students play the role of various community people who meet at a session of the county government's executive body to discuss the issues of this resolution.

Resolution 1: Be it resolved that, zoning regulations be changed to permit the construction of multi-family dwellings known as condominiums along the county's entire barrier beach.

After students choose which roles to play, read background material, research the issues, write out evidence, they will debate the resolutions in an open hearing before the county commissioners who will then discuss the "citizens' " presentations and vote on the proposed resolutions.

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Beaches Land Plan Faces Commission

December 9, 1972

By BLANTON McBRIDE
Staff Writer

Brevard County commissioners got a final rundown Wednesday on a proposed beaches land use plan compiled by the Brevard County Planning Department on a crash basis in the last 90 days.

The plan, already subjected to three public hearings in the beaches area, is on the agenda of the commission for final approval today.

JOHN HANNAH, Brevard County development director, outlined the basis for the correlated land use plan as the need developed approximately eight months ago.

According to Hannah, the beaches land use plan is the first of four programs, the second will be a similar use plan for Merritt Island, the third will evolve around the major interchanges in the county and a fourth will tie all the programs together.

Utilized in the preparation of the beaches plan were the Brevard area transportation study; the county's utility plan; population predictions, including the 1970 census; and other plans and statistics in the planning inventory.

"WE TIED IN other considerations beyond the standard concepts in land use planning," Hannah said. "These were existing land use, existing densities and the capacity of proposed transportation facilities; reliability of the water supply and expansion potential and adequacy of sewage systems and expansion potentials."

Based on predicted population occupying different types of dwelling units, it was determined that by 1995, the beaches area of Brevard County from the cape south to Sebastian Inlet would have an estimated population of 114,300 with an ultimate possibility of 170,500 in the area.

"The plan takes into consideration the present existing land use within municipal boundaries and attempts to establish compatible contiguous usage in the county," Hannah said. "There has been no attempt to dictate to the cities how they should zone their lands."

FOR THE PURPOSE of the study, Hannah said they set up to five units per acre as low density, from six to 15 units as medium density and from 15-30 as high density residential.

Densities recommended in the plan are not based on present transportation facilities but on improvement of present roads. The plan recommends two additional mainland access roads or causeways to the beaches area.

A zoning board recommendation made part of the report is that the area south of Melbourne Beach to Sebastian allow a total of only 15 acres for motel development at 40 units per acre. This is based on the six laning of AIA and a total permanent residential development of 24,000.

"WITH TOURISTS and through traffic, we will be talking about 60,000 vehicles a day," Hanna said.

To questions regarding the limitations placed on the purchaser of beach frontages at up to $500 per front foot, Hannah said developers have already sounded out the planning department on proposals for planned unit developments, town house and the like, based on ten units or less per acre.

Ed Washburn, county planner, said the land use plan was to be considered a guide, flexible enough to incorporate future changes in technology.

"ALL SYSTEMS, transportation, water, sewer, are dependent on each other," he said. "For example, unless something is done in respect to water source in South Brevard before 1980, there will be some trouble."

To a suggestion by commissioner Gene Roberts a plan should not be one that could be altered everytime someone wanted a change, Washburn noted it was a "planner's hope to produce a plan never needing change but the possibility of changes in technology must be taken into consideration."

Both Washburn and Hannah indicated the 90 day program to produce the plan was sufficient and they would not come up with a different plan if six months were devoted to the task.

The land use plans now being produced are the third and most detailed ever prepared for the county and the first based on the 1970 census.

12-7-72

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STUDENT COMMENT NO. 22: Community Roles for "County Commission"

Read the list of roles below and choose one whose ideas you wish to represent.

County Commissioners:

Chairman --Insurance Executive
Commissioner --Electrical Engineer
Commissioner --Realtor
Commissioner --Sailboat Manufacturer
Commissioner --Automobile Dealer
Commissioner --Restaurant Owner
Commissioner --Conservationist
Commissioner --Scuba Diving Company-Executive
Commissioner --Funeral Home Owner

Public:

Home owner - business man
Contractor
Home owner - Pastor
Home owner - over 65
Surfer
State Representative
Home owner - Plumber - (Unemployed)
Head of Environment Group
Grocer
Tourist from Kansas
Police Chief
Fireman
Teacher
Scientist
Gardner
Teenagers (2)
Realtor
Banker
Housewife
Farmer
Sewage Treatment Operator
Director of a Local Park
Dock Worker
Carpenter
Waitress
Service Station Operator
Retired Naval Officer

STUDENT COMMENT NO. 23: Suggested Interview Questions for "County Commission"

1. Do you use the beach? How often? For what purpose--recreation, business, residence?
2. Do you live in a condominium? Have you thought of buying one?
3. What do you think a condominum is?
4. What effect do you think the building of condominiums along the beaches will have on the community?
   a. Economically
   b. Morally
   c. Educationally
   d. Politically
   e. Esthetically
   f. Ecologically
5. What do you think are the advantages/disadvantages of living in condominiums?
6. How would you directly be effected by the building of a great number of condominiums along the beaches? (restrictive use of beach? price of goods? taxes?)
7. Should there be laws made to regulate the building of such condominiums? If so, what?

STUDENT COMMENT NO. 24: Purpose for Jetties

A structure developed to modify or control sand movement is the jetty. This structure is generally employed at inlets in connection with navigation improvements. When sand being transported along the coast by waves and currents arrives at an inlet, it flows inward on the flood tide to form an inner bar, and outward on the ebb tide to form an outer bar. Both formations are harmful to navigation through the inlet, and must be controlled to maintain an adequate navigation channel. The jetty is similar to the groin in that it dams the sand stream. Jetties are usually constructed of steel, concrete or rock. The type depends on foundation conditions, wave climate and economic considerations. Jetties are considerably larger than groins, since jetties sometimes extend from the shoreline seaward to a depth equivalent to the channel depth desired for navigation purposes. To be of maximum aid in maintaining the channel, the jetty must be high enough to completely obstruct the sand stream. Jetties aid navigation by reducing movement of sand into the channel, by stabilizing the location of the channel, and by shielding vessels from waves. Adversely, sand is impounded at the updrift jetty, and the supply of sand to the shore downdrift from the inlet is reduced thus causing erosion of that shore. Prior to the installation of a jetty, nature supplies sand by transporting it across the inlet intermittently along the outer bar to return to the downstream shore.

"Manmade Effects on the Shore," Shore Protection Guidelines, Department of the Army Corps of Engineers, Washington, D.C., August, 1971, p. 45.

STUDENT COMMENT NO. 25: Description and Effects of Canaveral Port, Florida

Canaveral Port forms the southern boundary of the Cape Kennedy Air Force Station. Entrance from the Atlantic Ocean is in Canaveral Bight via a dredged channel and artificial cut through the barrier beach to a dike-inclosed harbor and turning basin in Banana River. The Army Corps of Engineers' project provides for maintenance of the 37 and 36-foot depth entrance channel and 35-foot depth turning basin; construction and operation of a sand transfer plant; relocation of the perimeter dike about 4,000 feet westward and extension of the harbor westward; two entrance jetties to the 12-foot depth contour; a lock; a channel and turning basin 31 feet deep near the relocated dike; and a barge canal 12 feet deep and 125 feet wide from the turning basin to the Intracoastal Waterway. Length of the project is about 11.5 miles. Construction of the lock was completed, and the lock opened to navigation, in 1965. The overall project is now about 62 percent complete. Work remaining to be done is construction of the sand-transfer plant and extension of the harbor.

Data from the Corps of Engineers' Canaveral Port report indicate that the inlet channel and the jetties are acting as a complete littoral barrier (see SC #19, p. 51), and that, for all practicable purposes, no southerly drift reaches the shores south of the inlet. Continued interception of the southerly drift at the inlet would deprive the beach south of the inlet of 50 x 350,000 cubic yards, or 17,500,000 cubic yards, during project life. Calculations indicate that such a volume of material not reaching the shore would mean a loss of about 475 acres. The sand-transfer plant authorized for Canaveral Harbor will consist of a semi-stationary dredge pump operating on a trestle constructed about 1,000 feet north of the existing north jetty. The trestle would extend to the 15-foot depth contour. Plant capacity would be 250 cubic yards an hour. Discharge would be at a point about 1,500 to 2,000 feet south of the south jetty. The plant would bypass about 90 percent of the estimated southerly littoral drift of 350,000 cubic yards a year. The remaining 10 percent, or 35,000 cubic yards, would settle in the channel and be removed by supplemental conventional dredging. To date the sand transfer plant has not been constructed.

STUDENT COMMENT NO. 28

Port Canaveral Activity Rising

TODAY Wednesday, May 10, 1972

Cargo handling at Port Canaveral has nearly tripled in the past five years, while value of the cargoes has quadrupled.

According to figures from the Florida State Chamber of Commerce, the Space Coast's outlet to the sea has been booming with imports, while exports have remained negligible.

Port Canaveral handled 1.3 million tons of cargo last year, with a total value of $28 million.

Imports accounted for all but about 65,000 tons of the traffic. The imports — mostly fuel oil, cement and newsprint — were valued at $20 million; exports were mostly citrus products.

Port Traffic in 1971 totaled 1.2 million tons, also valued at $28 million. According to the state chamber of commerce, exports consisted of a mere 850 tons of citrus products. The 1971 imports consisted of 920,300 tons of residual fuel oil (used by the paper stations of Florida Power & Light Co. and the Orlando Utilities Commission), 237,000 tons of cement and 32,000 tons of newsprint (printing paper for TODAY and the Orlando Sentinel-Star).

In previous years, exports were even smaller than in 1971, while imports were expanding rapidly. Cargo handled at the port in 1968 totaled 453,000 tons, valued at $7 million. This rose to 831,000 tons worth $15 million in 1969 and to 1 million tons worth $19 million in 1970.

"We're gaining a little bit every year," commented George King Sr., Canaveral Port Authority manager. Fuel oil and newsprint imports have been rising steadily, he pointed out, and cement imports would be rising if overseas plants could supply it.

STUDENT COMMENT NO. 27: The Applegate Case Study

The house sits there serenely awaiting the next wave to come near and splash against the barrier improvised from junk cars. Tourists and other curious passers-by holler out indignantly, "You built the house kinda close to the water, didn't you?". The year is 1972 and everyone is seemingly conscious of the environment and yet we find one person apparently building a junk pile in her own front yard. "An eyesore", some call it. Has she no sensitivity to the beauty of the ocean? Mrs. Lynne Applegate has a story to tell, a story that began in 1960 when the beach was big and beautiful. Miles north of the Applegate home, a port was developed by the U.S. Army Corps of Engineers and a jetty constructed to keep back the sand that normally flowed from the north to the south. The jetty was needed to keep the sand from filling up the channed depth, which is vital to the port. A few years later, in 1963, the property owners at the beach began to notice that they didn't have to walk as far to the ocean as they once did. The U.S. Army Corps of Engineers were quoted by the Brevard Sentinel-Star as "investigating the problem."

Years went by and no one offered a plan to keep chunks of the beach from washing out into the ocean. The movement of Hurricane Gladys in October of 1968 served to bring to public attention the dilemna of the Applegate home. Waves crept to within four feet of her home. An appeal to the local Civil Defense office by Mrs. Applegate brought little comfort. She was advised that Civil Defense couldn't do anything until the ocean waters started breaking against the house.

The seasons of hurricanes only accelerated the erosion of the beach. The jetty at the Port, while serving its intended function, was the sole cause of the erosion of beach properties. Sand which normally flowed down the coast and fed the hungry, pounding surf was building up on the shore north of the jetty, while hundreds of feet of ocean front land to the south were swallowed whole by the ocean, never to return. At the urging of Mrs. Applegate, every level of government became aware of her vanishing property. A Brevard County Commissioner in 1968, George King, Jr., endorsed a plan to install a palmetto log jetty backed up with surplus concrete debris in front of the Applegate home as an effort to change the direction of the current. Commissioner King consulted with the Superintendent of the County District 3 Road and Bridge Department, George Hamilton,

and County Engineer, Earl Melvin, and got the approval of William Carlton of the Beaches and Shore Division of the Florida State Department of Conservation. Work was begun. This construction project was approved by State and County officials as an emergency measure while a more permanent solution to the erosion was being devised.

The U. S. Army Corps of Engineers, who first constructed the port jetty which caused the problem, began to talk of plans to construct a 1.8 million dollar "sand transfer plant" on the north side of Port Canaveral Harbor entrance. Once the plant is operational, sand would be pumped through underground pipes from the north side over to the south side in an attempt to recreate what was once a natural flow. When this plan was devised, in the fall of 1968, they held out hope that the "sand transfer plant" would be complete in two years. But what of the property already lost to the ocean? The "sand transfer plant" would only hope to maintain the existing shoreline, not rebuild it.

The possibility of re-building the beach property was often discussed by city, county, state, and federal officials who devised a plan using federal money to "match funds" with local and state monies. The cost to restore 150 feet of beach was estimated to be 1.5 million dollars in early 1969 when these plans were first discussed. The plan had one particular requirement that made it unreasonable in the view of beach property owners. "Give up any claim of ownership to the beaches in front on your homes and the public funds will be available to rebuild them." "We cannot spend public money for the improvement of private property." The owners were given hard choices: relinquish ownership, or go to the wallet with other beach owners for a do-it-yourself project, or sit back and watch the waves roll in.

For Mrs. Applegate, and others, who years ago paid premium prices for land now submerged, the very thought of giving up any claim to it was totally absurd. While other property owners fought the idea in court Mrs. Applegate directed her efforts to fighting back directly against the pounding surf only four feet from her door!

Only 11 days after cement was poured between and around the palmetto log pilings in an effort to break waves and deter erosion, it was evident that the ocean was determined to have its usual gulp of sand even if

it had to go under concrete to get it!

On October 17, 1969, President Nixon ordered funds for planned federal construction projects be temporarily withheld; this delay halted the finalization of plans for the long awaited "sand transfer plant."

By late 1969 and early 1970, the ground in front of the Applegate home began to develop huge cracks. The situation, always serious, was now desperate! Mrs. Applegate attempted to get help from city, county, and state officials, but the answer was always the same, "We can't legally spend tax money to solve a problem of one private landowner." Taking the situation into her own hands, she hired a "drag-line" to move beach sand to the front of her home.

The drag-line filling operation was only a temporary solution in an effort to buy precious time while the three levels of government bureaucracy churned and dragged through the motions of planning an effective attack on the erosion problem at some future time. State legislators, meanwhile, passed laws regulating the dredging and land fill operations, popular methods that real-estate developers used to create building sites, wherever needed. Environmentalists generally believed this a victory, but for Mrs. Applegate and her neighbors on the shore, the law meant certain surrender to the will of the ocean, as use of a drag-line, and/or bulldozer, to rebuild their lost land was now deemed illegal.

The state legislators were made aware of the special erosion problems of Brevard County and in a law, passed July 2, 1970, made Brevard County an "erosion prevention district," allowing the county to assess .16 mills for erosion control. ($160,000 can be levied without a referendum) Anxious to raise their 1/4 share of the total $2 million project cost, the Brevard County Commission, in May of 1971, held a referendum asking the county property owners to tax themselves an extra 1/2 mill which would raise the required one-half million dollars the first year. The increased tax burden on the owner of a $20,000 home was to be only $7.50 per year, yet when it came to a vote, the answer was NO. The Brevard County budget for beaches remained a mere $75,000; this was far from the required $500,000 to set the project in motion.[1] Instead of a quick start on the erosion project, delays at all levels resulted: the U.S. Army Corps of Engineers delayed construction of the proposed "sand transfer plant" for further feasibility study; Congress required that the state and county governments have on hand one million dollars before they allocate their matching funds.

While funding problems enlarged, the beachfront continued to shrink at an even faster rate, assisted by a severe "northeaster" storm in December of 1971. Cape Canaveral City Manager, Bert Francis, estimated the damage at around $250,000, the value of the beach lost to the ocean.

The Cape Canaveral City Council at a regular meeting discussed a number of "drastic" actions they could take. (1) One way was a possible lawsuit against the Corps of Engineers and Port Canaveral. The City Attorney, Dick Scott, looked into possible grounds for such a suit and concluded that the city could not win against a semi-government agency such as the U. S. Army Corps of Engineers. The basic principle is that government agencies are "immune from lawsuits," an idea carried over from the English that the KING can to no wrong. One can sue to get an injunction to stop action, or one can sue to force an action (action for mandamus) but a cash settlement is near to impossible. (2) City Councilman, Rogers Graefe, suggested the city might look into the possibility of getting the beach area declared a "disaster area" paving the way for possible federal or state funds.

A "disaster Area" indeed! It was unlikely the area would now be declared a disaster; however, the public and the public officials have ignored for such a long time the following series which led to the real disaster:

1. Building a port that disrupted the natural flow of sand
2. Delaying, for lack of funds, the sand transfer plant, designed to restore this natural flow
3. Delaying the rebuilding of the beachfront until the money is raised and decisions made as to who owns the land
4. Losing the three beautiful palms to the ocean and being replaced by a palmetto-lot and cement barricade.

"Disaster" is a word usually attributed to some sudden, 24 hour tragedy striking without warning. During a disaster everyone moves to help and even money, that commodity scarcely around unusual circumstances, is immediately made available.

No help is immediately available for Mrs. Lynne Applegate and her home that dangles near the water, however. By outlawing the private use of drag-lines and bulldozers to rebuild the sand, the State of Florida left Mrs. Applegate only one other line of defense; her choice was building a sturdy barricade against the pounding surf. The county had tried before with state approval, but their barricade was ineffective. To the

log and cement barricade, weighty discards were piled. It was ugly, but it was intended to buy needed time, while governments bickered over who, how and when to restore her submerged land. Now the junk cars are added and suddenly the public is shocked. The Applegate house is a news story again. A complaint was made to city officials by an apartment house owner whose property is near enough to the Applegate property to see this daring new debris, yet far enough from the ocean as not be threatened yet himself. The city council of Cape Canaveral debates over what action to take. "If we find she is violating city dumping ordinances we can act ourselves," said City Manager, Bert Francis, adding that the city must first determine whether the State or even the Army Corps of Engineers has jurisdiction. It was determined, some of the new debris lay on property technically belonging to the city, and some debris was in an area defined as within the jurisdiction of the State of Florida Department of Natural Resources, who have authority on all matters from the "high water mark" (that edge of the surf at high tide) and 50 feet out into the ocean. Since the high water mark has moved several hundred feet in 12 years, that mark, technically, now runs through the middle of the Applegate house.

A letter from Mr. W. T. Carlton, Chief of Bureau of Beaches and Shores, State of Florida Department of Natural Resources explains the status of Mrs. Applegate's situation as of February, 1972:

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February 10, 1972

Mrs. L. H. Applegate
18 Washington Avenue
Cape Canaveral, Florida 32920

Dear Mrs. Applegate:

You will recall our recent telephone conversation relating to emergency measures to protect your beach front property. Our staff has inspected your property on several occasions since I talked to you.

As stated to you in our telephone converstaion, you should have secured the services of a professional engineer to advise you how to best protect your property. Also, you should have contacted us to secure permission to take this emergency action. We would have cooperated with you in every possible way and would have been in a position to give you some advice. Since you apparently elected to proceed without proper technical advice and without State approval, as required by Florida Statutes, we must now insist that you make a full report to us regarding this activity.

We are of the opinion that some of the material placed in front of your property helped to give you temporary protection. However, we must now request that you take immediate steps to clear the area of all debris such as old cars, tires, wood, and other material which will eventually disintegrate or be washed onto adjacent property. Your failure to comply with this request will make it necessary for us to take action as provided in Florida Statutes.

You are further advised that after a complete "clean-up" of the present situation, consideration should be given to some kind of permanent protection. Again you are advised to seek the assistance of a professional engineer. Such action at this time may well prevent your having to take emergency action in the future.

Please advise immediately your agreement to remove all loose debris, old cars, etc., as requested above.

Sincerely,

W. T. Carlton, Chief
Bureau of Beaches and Shores

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The issue remains unresolved. The federal government used "public funds" to construct the port which caused the erosion problem - everyone agrees on that point. The area of disagreement lies in efforts to correct the problem. "We can't use public funds to improve private property" is a common response by government officials, yet public funds were used to destroy (in effect) private property. The federal government is willing only to pay one-half the cost to restore what they themselves destroyed leaving the remaining burden falling upon the community and state that years ago welcomed this federal port project.

In his letter to Mrs. Applegate, Mr. Carlton urged her to "seek the assistance of a professional engineer," . . . implying that she, a private citizen pay to build a barricade to protect what remains of her property from further damage by government caused erosion, and after building the barricade, she must also be content to claim only that property contained within the barricade once the government finishes rebuilding what was lost and calling it "public beach."

There is also the question of designing a workable barrier. Even consulting a "professional engineer" is no guarantee. In 1968, before the log jetty was constructed in front of the Applegate home, Brevard County engineers were consulted. Even Mr. Carlton approved the project, yet that barrier was totally ineffective. Mrs. Applegate's own engineering, while unsightly to be sure, has been more effective. The danger from broken glass and slivers of metal is no greater than the tons of glass bottles and metal beverage cans left on the beach each year by the same public that targets Mrs. Applegate for their outrage.

What is more outrageous, however, is that the State of Florida, through Mr. Carlton's office is determined to enforce a law "statute #161.052," which prohibits construction on a beach without a waiver from the State's Department of Natural Resources. Maxium penalty is a misdeameanor fine of $500 to $1,000.

Because she has failed to yield to directives from state officials insisting that she remove the junk car breakwater, Mrs. Lynne Applegate now faces a possible civil suit by the state's attorneys office.

In late April, 1972, Mrs. Applegate received court notice to remove her makeshift barriers.

When the case appears in court,[2] a number of key issues will need to be resolved. In defense of Mrs. Applegate, she could make any one of the following claims:

CLAIM 1. The state has no jurisdiction because the "high water mark" should be defined as that edge of the surf at high tide when the property was purchased, not where it happens to fall, each year inching closer.

CLAIM 2. The state statute under which she is to be penalized (prohibits "construction" on a beach . . . etc.) is not applicable because she did no "constructing."

CLAIM 3. The federal government has damaged her property and with supporting evidence bring counter-suit against the federal government to force action to rebuild her property (action for mandamus) and seek cash re-imbursement for fines and other penalties likely to be imposed by the state and for local governments.

If you were the prosecuting attorney for the state, or federal governments, what arguments would you use to present your case?

If you were the defense attorney, what collection of undisputed facts might help you substantiate any

one, or all three of the hypothetical defense claims?

If you were the owner of the Applegate home and property, what would you have done, or what would you do now?

1. Brevard County Commission has since reversed the voters on the beach erosion referendum and decided to spend $160,000 for its share of the erosion control plan.

2. Today newspaper reported on May 6, 1973, the case against Mrs. Applegate is still pending.

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STUDENT COMMENT NO. 28: Changes in the Barrier Beach

Today, we find that although there are still many beautiful beaches for outdoor enjoyment, in most areas there is less and less sand reaching them and they erode. Causes for our shrinking beaches are in general the normal geologic changes and changes made by man. Considering a very long-term basis, the slow rise in sea level, if it continues, will submerge part of the present beaches. However, this rise is so slow that changes occurring in the course of a normal human lifetime will not be noticeable without measurement by precise gages. Changes which occur on a shorter-term basis, and which are of greater urgency, are those caused by development of the shore by man for various purposes. As shore areas are developed, attempts are made to stabilize the beaches and stop erosion of the bluffs which would normally furnish sand to the beaches. Therefore, there is less material available for replenishment of the moving sands.

Numerous factors control the growth of development at beach areas, but undoubtedly the beach is the resort's basic asset. The desire of visitors, residents, and industries to find accommodations as close to the ocean as possible has resulted in man's encroachment on the sea. There are numerous places where the beach has been gradually widened by natural processes over the years; lighthouses and other structures which once stood on the beach now stand hundreds of feet inland. In their eagerness to be as close as possible to the water, developers and property owners often forget that land comes and goes, and that land which nature provides at one time may later be reclaimed by the sea. Yet once the seaward limit of a development is established, this line must be held if large investments are to be preserved. This type of encroachment has resulted in great monetary losses due to storm damage and ever-increasing costs of protection.

Flood control and water supply dams are necessary to the everyday life and safety of people, yet these dams often alter the flow of water which brings sand from inland to the shore. They may in some instances trap sand that would move to the sea by the action of normal flows. Improvements of inlets and river mouths for navigation cause interruptions of the sand movement or shifting of the sand to deeper water from where most of it may never return to the shores. Unless means are provided to overcome these losses of beach sand from the shore zone, or methods are devised to reduce the effects of development, stabilizing beaches will become an ever-increasing problem.

Department of the Army, Corps of Engineers, Washington, D. C., Shore Protection Guidelines, August, 1971.

STUDENT COMMENT NO. 29: Shore Protection Methods • Bulkheads, Seawalls and Revetment

Measures designed to stabilize the shore fall into two general classes: (a) a structure to prevent waves from reaching erodible materials; and (b) an artificial supply of sand to the shore to make up for a deficiency in sand supply through natural processes, with or without structures such as groins to reduce the rate of loss of littoral material.

One set of structures built to reduce wave action is described in the following paragraphs.

BULKHEADS, SEAWALLS AND REVETMENTS

Protection on the upper part of the beach, fronting backshore development, is required as a partial substitute for the natural protection that is lost when the dunes are destroyed. Shorefront owners have resorted to armoring of the shore by wave-resistant walls of various types. A vertical wall in this location is sometimes known as a bulkhead, and serves as a secondary line of defense in major storms. Bulkheads are constructed of steel, timber, or concrete piling. Typical steel and timber pile bulkheads are shown on Figure 1 and a concrete pile bulkhead is shown on Figure 2. For ocean-exposed locations, bulkheads do not provide a long-lived permanent solution, because eventually a more substantial wall is required as the beach continues to recede and larger waves reach the structure. Unless combines with other types of protection, the bulkhead eventually evolves into the massive seawall capable of withstanding the direct onslaught of the waves. Extensive seawall structures have been built principally in Massachusetts, Florida, Mississippi, Texas and California. Seawalls may have vertical, curved or steppsd faces (see Figures 3, 4, and 5). While seawalls may protect the upland, they do not hold or protect the beach which is the greatest asset of shorefront property. In some cases, the seawall may be detrimental to the beach in that the downward forces of water, created by the waves on striking the wall, rapidly remove sand from the beach. The Galveston seawall, shown on Figure 5, includes a stone apron to minimize scouring of the beach and undermining

the wall.

A revetment armors the slope face of a dune or bluff with one or more layers of rock or concrete. This protection dissipates wave energy with less damaging effect on the beach than waves striking vertical walls. A rock revetment built at Cape Henry, Virginia, is shown on Figure 6. A concrete-block revetment in a more exposed location fronting on the Atlantic Ocean at Jupiter Island, Florida, is shown on Figure 7.

Adequately designed bulkheads and revetments usually cost about $75 to $150 per foot of shore protected, depending upon exposure to wave action, total length, and proximity to sources of construction material. The cost of this type of protection might exceed $400 per foot in some areas. Seawalls and breakwaters (the latter discussed in the next section) are more expensive and are usually built only in the more openly exposed sites. Their estimated cost begins at, say, $200 per foot and ranges considerably above $500 per foot for massive structures far from rock sources.

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* Figures 1-7 are found on pages 72-75.

Department of the Army, Corps of Engineers, Washington, D. C., Shore Protection Guidelines, August, 1971.

Figure 1. Timber Sheet Pile Bulkhead

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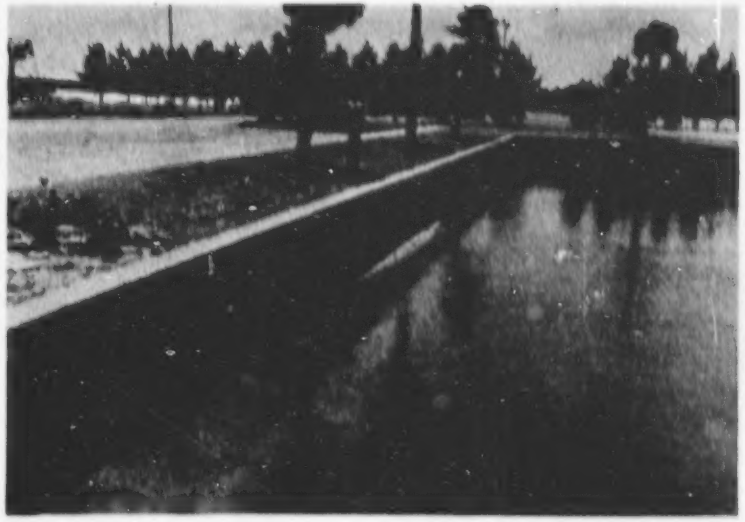

Figure 2. Precast Concrete Sheetpiles, Daytona Beach, Florida

Figure 3. Vertical-face Concrete Seawall built 25 years ago at Watch Hill, Rhode Island.

Figure 4. Concrete Combination Stepped and Curved-face Seawall, San Francisco, California

Figure 5. Seawall at Galveston, Texas

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Figure 6. Stone Revetment at Cape Henry, Virginia

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Figure 7. Interlocking Concrete-Block Revetment at Jupiter Island, Florida

STUDENT COMMENT NO. 30: Shore Protection Materials • Breakwaters

Measures designed to stabilize the shore fall into two general classes: (a) a structure to prevent waves from reaching erodible materials: and (b) an artificial supply of sand to the shore to make up for a deficiency in sand supply through natural processes, with or without structures such as groins to reduce the rate of loss of littoral materials.

One set of structures built to reduce wave action is described in the following paragraphs.

BREAKWATERS

Beaches and bluffs or dunes can be protected by an offshore breakwater that prevents waves from reaching the shore. However, offshore breakwaters are more costly than onshore structures, and are seldom built solely for this purpose. Offshore breakwaters are constructed mainly for navigation purposes. A breakwater enclosing a harbor area provides shelter for boats. Breakwaters have both beneficial and detrimental effects on the shore. All breakwaters reduce or eliminate wave action and thus protect the shore immediately behind them. Whether offshore or shore-connected, the elimination of wave action reduces littoral transport, obstructing the free flow of sand along the coast and starving the downstream beaches. At a harbor breakwater, the sand stream generally can be restored by pumping the sand through a pipeline from the side where sand accumulates to the starved side. This type of operation, in use for many years at Santa Barbara, California, is illustrated by Figure 8.* Even without a shore arm, an offshore breakwater stops wave action and creates a quiet water area between it and the beach. In the absence of wave action to move the sand stream, the sand is deposited and builds the shore seaward toward the breakwater. The buildup actually serves as a barrier and completely dams the sand stream, depriving the downdrift beaches of sand. Although this type of construction is generally detrimental to downstream beaches, there is one case in which it may be used to aid the beach processes. When placed on the updrift side of a navigation

opening, the structure impounds sand, prevents it from entering the navigation channel, and affords shelter for a floating dredge to pump the impounded material across the navigation opening back into the stream of sand moving along the shore. This method is used at a harbor near Port Hueneme, California.

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* Figure 8 is found on page 81.

Department of the Army, Corps of Engineers, Washington, D. C., Shore Protection Guidelines, August, 1971.

STUDENT COMMENT NO. 31: Shore Protection Materials • Groins

Measures designed to stabilize the shore fall into two general classes: (a) a structure to prevent waves from reaching erodible materials; and (b) an artificial supply of sand to the shore to make up for a deficiency in sand supply through natural processes, with or without structures such as groins to reduce the rate of loss of littoral material.

One set of structures built to reduce wave action is described in the following paragraphs.

GROINS

Long ago investigators noted that obstructions on a beach, such as logs or wrecks, would trap sand moving along the beach and cause the beach to widen Such observations led naturally to devising the groin, a barrier-type structure which extends from the backshore into the littoral zone of sand movement. In earlier times, prior to the current extensive development of upstream river basins and major portions of the seacoast, the natural supply of beach sand was plentiful, and in many instances groins succeeded remarkably well. (Figure 9* shows a successful groin system.) This led to further, excessive, and indiscriminate use of groins. They often were installed without considering all the factors pertaining to the particular problem. Figure 10 has had only marginal success at improving the beach because of an insufficient natural supply of sand. However, this system has presumably somewhat reduced the rate of loss of sand and the rate of shore recession.

The basic purpose of a groin is to interrupt alongshore sand movement to accumulate sand on the shore or to retard sand losses. Trapping of sand by a groin is done at the expense of the adjacent downdrift shore unless the groin or groin system is filled with sand to its entrapment capacity. To reduce the potential for damage to property downdrift of a groin, some limitation must be imposed on the amount of sand permitted to be naturally impounded on the updrift side. Since more and more shores are being protected, and less and less sand is available as natural supply, it is now desirable, and frequently necessary, to place

sand artifically to fill the area between the groins, thereby ensuring a more-or-less uninterrupted sand supply to downdrift shores.

Groins have been constructed in many ways using timber, steel, concrete or rock, but can be classified into basic physical categories as high or low, long or short, and permeable and impermeable.

A high groin extending through the zone of breaking for ordinary or moderate storm waves initially entraps nearly all of the alongshore moving sand within that intercepted area until the a real pattern or surface profile of the accumulated sand mass allows sand to pass around the seaward end of the structure to the downdrift shores. Low groins (top profile no higher than that of desired reasonable beach dimensions) function like high groins, except that appreciable amounts of sand also pass over the top of the structure. Permeable groins permit some of the wave energy and moving sand to pass through the structure.

Experience has shown that a short groin in heavy drift areas may fill quickly and have a limited effect on adjacent beaches. High groins, particularly if they extend beyond the breaker zone for most waves, adversely affect downdrift shores long after their updrift-side impounding capacity is reached. This is caused by diversion of littoral drift offshore beyond the end of the groin where its subsequent movement deprives downdrift beaches of an adequate supply of nourishment. The accreted sand adjacent to the updrift side of a long groin may result in such a different shore alignment from that of the natural ungroined shore that sand movement along that alignment by waves is retarded for many years. Short groins, and groins which have an appreciable degree of permeability, do not cause a pronounced setback in the shore immediately downdrift of the groin as the littoral transport of sand over and through these structures allows a more continuous supply to the downdrift area. Present knowledge of sediment transport by waves and currents does not permit satisfactory determination of the optimum degree of permeability for proper functioning of permeable groins. Impermeable groins can be more readily designed to serve the desired purpose, and they are more widely used. But groins of any type should not be built unless properly designed for the particular site. The

effects of the contemplated groins on adjacent beaches should be studies by an experienced engineer.

Adequately designed protective groins may cost about $100 to $350 per foot of shore protected dependent upon such factors as exposure to wave action, range of tide, and accessibility of building materials. This is the cost range for groin structures only -- where beach fill is also required to prevent adverse effect on downdrift shores, the cost increases accordingly.

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*Figures 9-10, pages 81-82.

Department of the Army, Corps of Engineers, Washington, D. C., Shore Protection Guidelines, August, 1971.

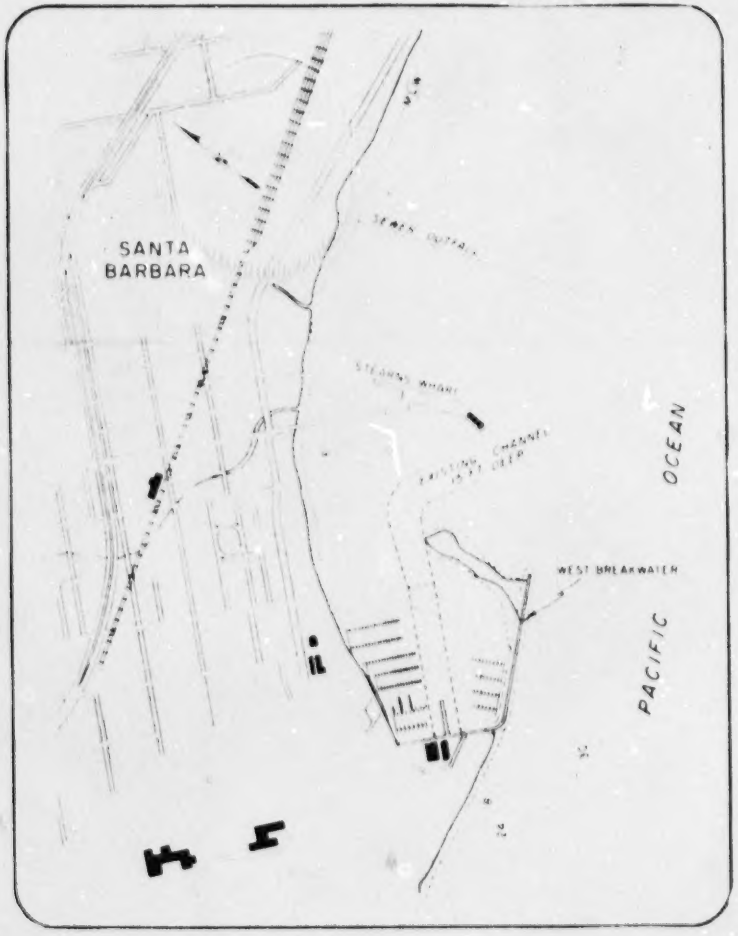

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Figure 8 (Above). Sand Bypassing at Santa Barbara, California. Sand dredged from inside the breakwater is pumped to downdrift beach.

Figure 9 (Right). Groin System--Willoughby Spit, Virginia

Figure 10. Groin System at Miami Beach, Florida (April 1962)

STUDENT COMMENT NO. 32: Shore Protection Methods • Jetties

Measures designed to stabilize the shore fall into two general classes: (a) a structure to prevent waves from reaching erodible materials; and (b) an artificial supply of sand to the shore to make up for a deficiency in sand supply through natural processes, with or without structures such as groins to reduce the rate of loss of littoral material.

One set of structures built to reduce wave action is described in the following paragraphs.

JETTIES

A structure developed to modify or control sand movement is the jetty. This structure is generally employed at inlets in connection with navigation improvements (see Figure 11*). When sand being transported along the coast by waves and currents arrives at an inlet, it flows inward on the flood tide to form an inner bar, and outward on the ebb tide to form an outer bar. Both formations are harmful to navigation through the inlet, and must be controlled to maintain an adequate navigation channel. The jetty is similar to the groin in that it dams the sand stream. Jetties are usually constructed of steel, concrete or rock. The type depends on foundation conditions, wave climate, and economic considerations. Jetties are considerably larger than groins, since jetties sometimes extend from the shoreline seaward to a depth equivalent to the channel depth desired for navigation purposes. To be of maximum aid in maintaining the channel, the jetty must be high enough to completely obstruct the sand stream. Jetties aid navigation by reducing movement of sand into the channel, by stabilizing the location of the channel, and by shielding vessels from waves. Adversely, sand is impounded at the updrift jetty as shown on Figure 11, and the supply of sand to the shore downdrift from the inlet is reduced thus causing erosion of that shore. Prior to the installation of a jetty, nature supplies sand by transporting it across the inlet intermittently along the outer bar to return to the downstream shore.

To eliminate undesirable downdrift erosion, some projects provide for dredging the sand impounded

by the updrift jetty and pumping it through a pipeline to the eroding beach (see Figure 12). This ensures an uninterrupted flow of sand alongshore to nourish the downdrift beach, and also prevents shoaling of the entrance channel. At Shark River Inlet, New Jersey, sand was transported across the inlet by truck with beneficial results.

A more recent development provides a low section or weir in the updrift jetty over which sand moves into a predredged deposition basin. By dredging the basin periodically, deposition in the channel is reduced or eliminated. The dredged material is normally pumped across the inlet to provide nourishment for the downdrift shore. A "weir-jetty" at Masonboro Inlet, North Carolina, is shown on Figure 13.

• Figures 11-13, pages 85-86.

Department of the Army, Corps of Engineers, Washington, D. C., Shore Protection Guidelines, August 1971.

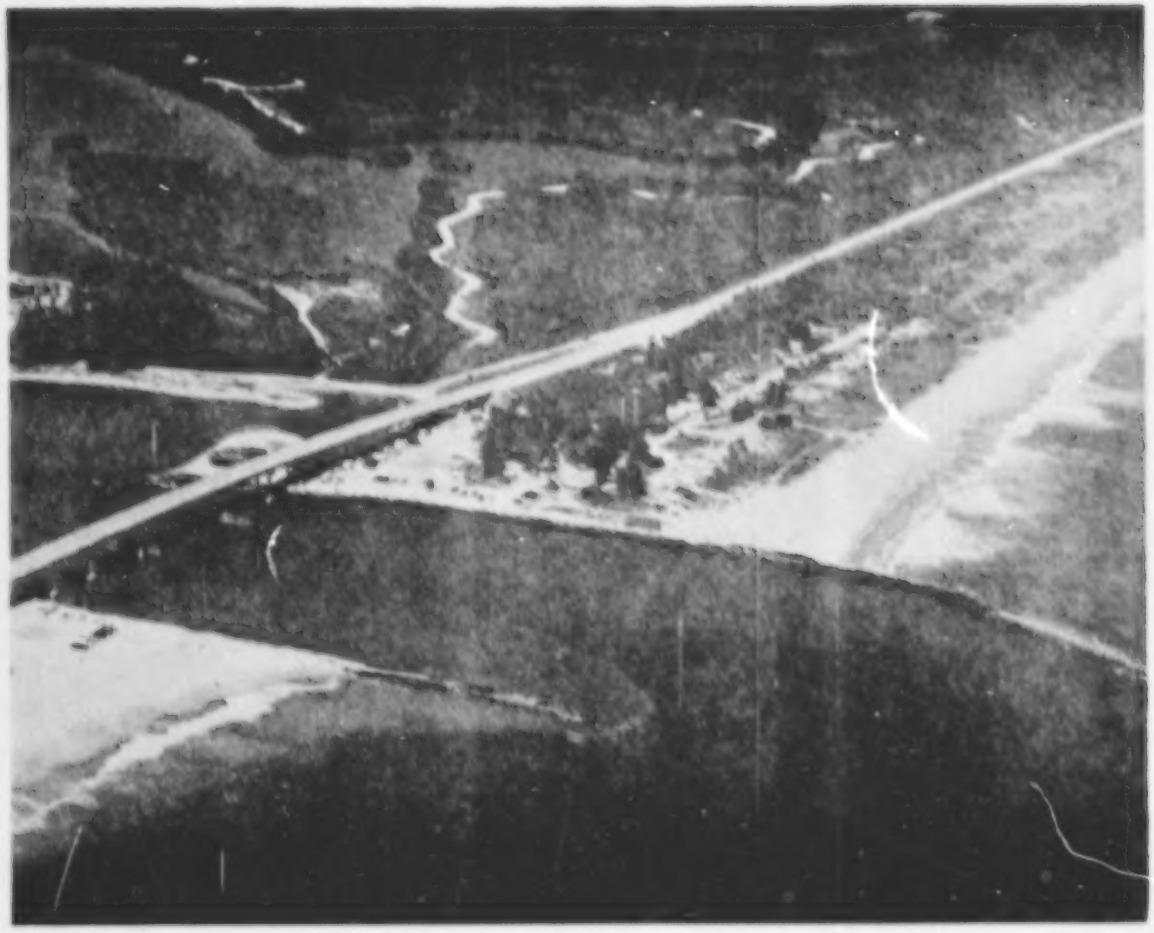

Figure 11. Jetties at Sebastian Inlet, Florida. (Note widened beach adjacent to updrift jetty and eroded downdrift shore.)

Figure 12. Fixed Bypassing Plant--South Lake Worth Inlet, Florida (Above)

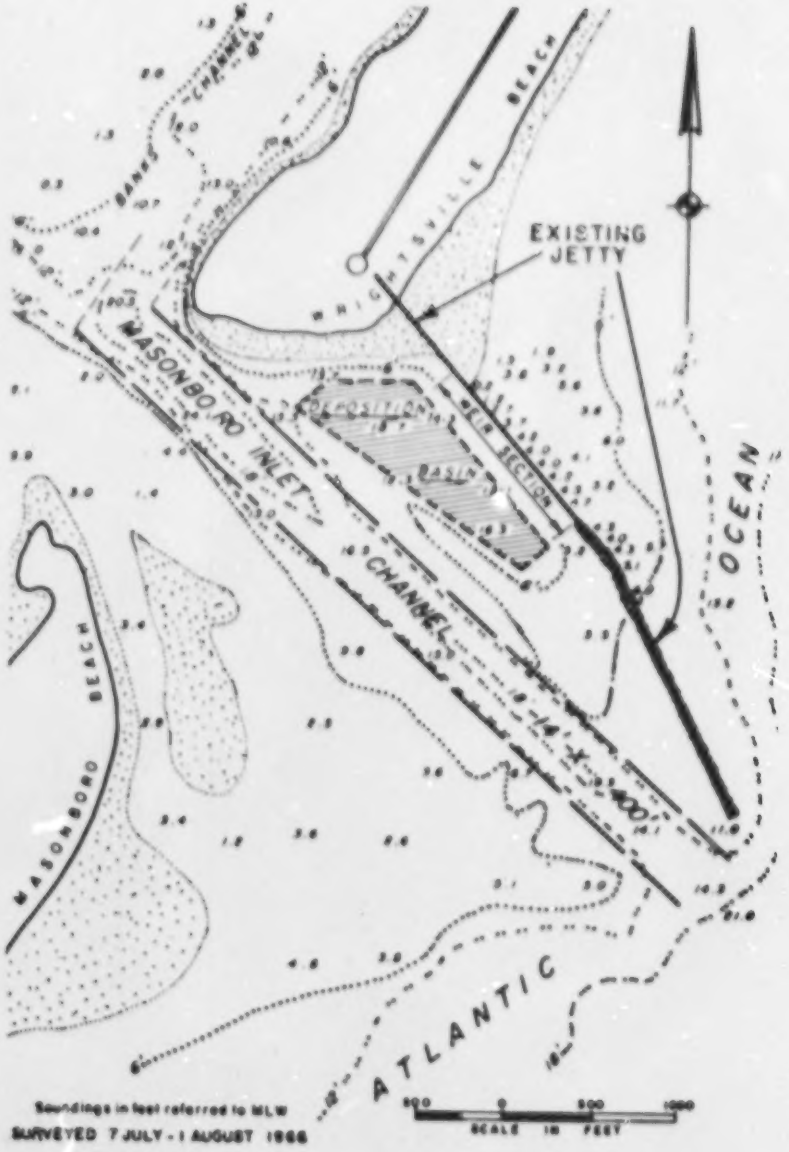

Figure 13. Masonboro Inlet, North Carolina (July 1966) (Right)

STUDENT COMMENT NO. 33: Shore Protection Methods • Artificial Supply of Sand

Measures designed to stabilize the shore fall into two general classes: (a) a structure to prevent waves from reaching erodible materials; and (b) an artificial supply of sand to the shore to make up for a deficiency in sand supply through natural processes, with or without structures such as groins to reduce the rate of loss of littoral material.

The paragraphs below describe artificial means of supplying needed sand to the barrier beach.

BEACH RESTORATION AND NOURISHMENT

Beach structures, when properly used, have a place in shore protection. But research has shown that the best protection is afforded by using methods as similar as possible to natural ones. In other words, a greater degree of effectiveness is obtained by the type of protection provided by nature, which permits the natural processes to continue unhampered. To simulate natural protection, dunes and beaches are rebuilt artificially. Sand from sources behind the beach or offshore is placed on the shore. Figures 14* and 15 show views of Harrison County, Mississippi, after and before artificial restoration of the beach in front of the sea-wall with sand from the offshore bottom. This project was completed in 1952 and thus far has required minor maintenance. To ensure continued stability of the beach, material is placed periodically to make up deficiencies in the natural supply. This is most economical for long beaches as the increase of supply benefits the entire beach.

Coastal engineers can now determine required dune and beach dimensions to protect against storms of any given intensity. Dune heights sufficient to prevent overtopping by waves, and dune widths sufficient to withstand the erosion of a given storm can be determined. Also, beach dimensions, including height and width of berm and characteristics of sand required to maintain beach slopes, can be designed to withstand storms of a specified degree of severity. Sometimes structures must be provided to protect dunes, to maintain a

specific beach shape, or to reduce nourishment requirements. In each case, the cost of such structures must be weighed against the added benefits they would provide. Thus, measures to provide and keep a wider protective and recreational beach for a relatively short section of an eroding shore would require excessive nourishment without supplemental structures such as groins to reduce the rate of loss of material from the widened beach. A long, high terminal groin or jetty is frequently justified at the downdrift end of a beach restoration project to reduce losses of fill into an inlet and to stabilize the lip of the inlet.

Beach fill for most beach widening or restoration can be expected to cost about $50 to $300 per foot of shore receiving the initial fill, depending on exposure, proximity of suitable fill borrow sites, length of beach, and degree of restoration required. Periodic nourishment may be required at intervals of 1 to 5 years at costs estimated to range from $5 to $15 per foot of shore per year, for straight beaches at least 2,000 feet long. It may be uneconomic, or even impracticable, to attempt nourishment of small segments of beach without retaining structures. The above estimates do not include dune rehabilitation and maintenance.

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Another lesser used artificial means of restoring dunes is the construction of sand fences. Such construction then allows the planting of vegetation to hold the sand in place. Figure 16 shows a dune produced in such a manner.

*Figures 14-16, pages 89-90.

Department of the Army, Corps of Engineers, Washington, D. C., Shore Protection Guidelines, August 1971.

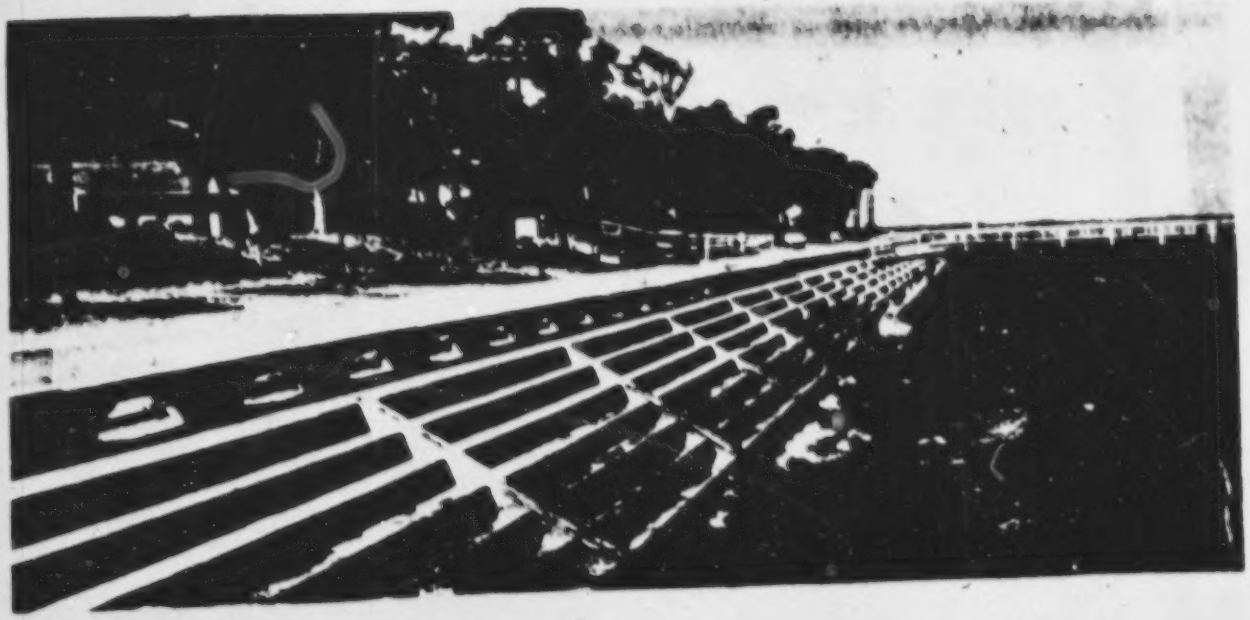

Figure 14. Concrete Stepped-face Seawall--Harrison and Hancock Counties, Mississippi.

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Figure 15. Concrete Stepped-face Seawall in Harrison and Hancock Counties, Miss. (after placement of beach fill).

Figure 16. Dunes formed by trapping windblown sand with fences and grasses, Outer Banks, North Carolina.

STUDENT COMMENT NO. 34: Evaluation Form for Visuals

Four areas for the evaluation of visuals are suggested. Each area should be rated by the following scale: 5 points-excellent; 4 points-above average; 3 points-average; 2 points-below average; 1 point-poor. Note: part 4, Clarity, has four sub-areas which combine to make the total value for part 4.

Student's Name _____ Title or Topic _____

POINTS	AREA OF EVALUATION
_____	1. APPROPRIATENESS If the student has had an opportunity to select either the topic or method of his presentation, is the choice of either or both appropriate to the assignment?
_____	2. ACCURACY Are the facts used in the presentation accurate? If not, where is the inaccuracy?
_____	3. COMPLETENESS Does the presentation represent a complete statement or coverage of the subject (is there material or facts omitted which makes the presentation misleading)? If not, where is the presentation lacking?
_____	4. CLARITY Is the presentation clear to the viewer? _____ a. Is the viewer readily able to determine the point or message contained in the presentation? _____ b. Is the presentation free from unnecessary distractions? (pictures, drawings, etc. which do not contribute to the purpose? _____ c. Are the colors and sizes of lines, bars, and/or pictures suitable? _____ d. In the case of a collage or drawing, is the focal point clearly determined?
_____ (Total Points)	COMMENTS: _____

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STUDENT COMMENT NO. 35: Federal Development Process for Erosion Control Projects

Shore protection and beach restoration projects conducted by the U. S. Army Corps of Engineers begin with a local request for help. Any person or group of persons desiring assistance in combating beach erosion can obtain information and advice from any Corps of Engineers District or Division office. Eroded publicly owned shores and shores eroded because of Federal navigation works are eligible for Federal assistance; privately owned shores may be eligible for Federal assistance if there is public benefit such as that arising from public use. Parties desiring information, advice, and assistance in combating beach erosion can usually be most effective by acting through and in cooperation with the State, county, or city agency concerned with beach and shore use and management. The agency, in turn, can reinforce its effectiveness by early consultation with the appropriate District or Division Engineer to explore any question of eligibility and applicability of the small project program, or the program for mitigating erosion caused by Federal navigation works. If either of these programs is applicable, the Secretary of the Army can authorize a beach erosion study at the request of the responsible local agency. If the study shows the project to be justified and the local interests involved are willing and able to cooperate as required by law, the Secretary of the Army can authorize construction of the project and allot funds for that purpose from available civil works appropriations.

Beach erosion studies for the regular project program must be individually authorized by the Congress. Usually, the study authorization is granted by a resolution approved by the Public Works Committee of either the Senate or the House of Representatives; less frequently, it is included in a River and Harbor Act adopted by the Congress and approved by the President. If consultation with the District or Division Engineer indicates that the small project program is inapplicable, the local interests involved, acting through the community's elected representatives in the Congress, should request the Congress to authorize and fund a beach erosion investigation and study. The District or Division Engineer will begin the study as soon as the necessary authorization and funds are provided.

Normally, the local interests sponsoring the study and the District or Division Engineer responsible for its prosecution will continue consultations, exchange information, and make plans for conducting the study while the authorization and fund allocation actions are in progress.

The investigation and study are intended to determine whether a Federal project is justified and, if so, whether its construction is feasible. One of the early concerns of the Engineer Officer directing the study is the ascertainment of the desires and opinions of all parties affected by, or having an interest in, the protection, improvement, and use of the shore area concerned. To this end, he holds a public hearing at the beginning of the study; if the situation warrants, he holds additional hearings as the study progr gresses. The study thoroughly examines the problem and identifies the causal factors. After careful analyses of the impacts of all applicable remedial measures on the erosion problem, on other shore areas, on the regimen of the coastal waters, on areal shore processes, on marine life, on ecological values, and on shore uses, a general plan for shore protection and beach restoration is devised. If comparisons of the costs of construction and the benefits resulting from the construction show the project to be a sound and prudent public investment, and if the local sponsoring agency affirms willingness and ability to provide the required cooperation, the report on the study recommends adoption of the project. Before the report is submitted to the Congress, it is reviewed by the Board of Engineers for Rivers and Harbors, the Chief of Engineers, the Governors of affected States, and all interested Federal departments.

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Projects authorized for construction by the Congress are considered by the Congress as it formulates the annual appropriation bill. (As previously mentioned, funds for constructing the small project construction program are allotted by Secretary of the Army and are not specifically appropriated for individual projects.) As soon as funds are provided, the responsible District Engineer carries out the detailed engineering work essential to construction and prepares construction drawings and specifications. Contractors submit bids based on these drawings and specifications and a construction contract is awarded to the successful bidder. The District Engineer continues to consult and coordinate with the local sponsor-

ing agency while engineering and construction are underway. Upon completion, the protective works are turned over to the sponsoring local interests for operation and maintenance in accordance with the authorizing legislation. Section 215 of Public Law 90-483 permits local interests to expedite construction of authorized projects for which Federal funds are not immediately available. Under certain circumstances if local interests proceed with construction at their expense, the Federal share of the cost of that construction can be reimbursed from later appropriations. Such reimbursement cannot exceed $1 million.

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STUDENT COMMENT NO. 36

Sunday, February 11, 1973 Sentinel Star Orlando, Florida

California Attempting Bold Plan To Regulate Coast

New York Times Dispatch

LOS ANGELES — One of the nation's boldest ventures in land use planning, the state-level regulation of California's 1,000-mile coastline, is gearing up — and confronting problems.

The California coastal zone conservation commission, created by a nationally watched vote of citizens last November, held its first substantive meeting here this week.

THE 12-MEMBER citizen panel, which will have veto power over almost any coastal development — including private-home construction on private land — found itself instantly embroiled in a tangle of questions.

They ranged from how to cope with an impending avalance of building-permit applications, to how to stretch the commission's statutory $5 million budget over the next four years, to what to do about a big oil company that, only a few miles away, was energetically punching holes in the coastal crust without a commission permit.

The commission's first official act was to ask the oil company, the Occidental Petroleum Corporation, to suspend operations pending investigation of their legality by the state attorney general. A few hours later the state supreme court ordered suspension of the project, in a suit brought by conservationists, pending an analysis of environmental impact.

ALTHOUGH the current permit zone extends only from high tide to 1,000 yards inland, the commission's long-range planning jurisdiction extends from three miles at sea to five miles inland — a total of roughly 8,000 square miles. About 60 per cent of the shoreline is privately owned.

California is the first state to introduce such comprehensive shoreline regulations, and the undertaking therefore is in a sense a pilot project with implications for the nation's entire 53.677 miles of coastline, near which the greater part of the country's population is clustered. Congress passed a law last year to provide matching-fund grants to encourage coastal planning by states.

The California effort resulted from a resounding "yes" vote on last November's ballot proposition 20, an initiative measure strenuously opposed by industrial and real estate interests the nation.

Under the measure, effective Feb. 1, anyone proposing almost any shoreline development that will diminish beach land, hamper public access to beaches, or even obstruct views of the ocean, must obtain a permit.

THE CHIEF exceptions are private-home improvements costing under $7,500 and San Francisco Bay where development is under the jurisdiction of a recently created special state agency.

Violators of the law are subject to fines of up to $10,000, plus levies of up to $500 for each day's violation.

The law has been challenged as an unconstitutional "confiscation" of property in a class-action suit filed by some property owners. It is pending in the Los Angeles county superior court.

The issuance of permits is up to six regional subcommissions, composed of half city and county representatives and half of private citizens appointed by the governor and legislative leaders. The law affects 15 of California's 58 counties and 45 sizable cities.

The statewide commission, designed to serve mainly as a policy-making body and an appellate panel, in turn is composed half of appointees and half of representatives of the regional commissions.

THE WEEKS since the November election have been punctuated with parochial squabbling as conservationists on the one hand and "development" interests on the other vied to maneuver representatives onto the various commissions.

A number of individuals antagonistic to state-level shoreline management go on commissions, mostly as local government representatives.

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Ponce Inlet Demands Erosion Remedy Fast

Sentinel Star Bureau

DAYTONA BEACH — The beefed-up Ponce Inlet Port Authority may rush into beach erosion remedies, an area where the U. S. Army Corps of Engineers fears to tread without a five-year study.

Property owners insist the sea is eating away sand from the inlet at least a mile north. They believe the loss is less than that two months ago when high winds formed six-foot waves which eroded more than 30 horizontal feet of beach in about two weeks.

THE CORPS refuses to acknowledge there is any erosion in the area. Under its contract with the authority, a local taxing agency, Army engineers constructed jetties to stabilize the inlet and must maintain them perpetually.

Director William Carlton of the Florida Bureau of Beaches and Shores calls the jetties poorly designed and thinks they aid erosion processes.

He believes pumps could lay sand on the gnawed out beach but unless the jetties are changed, "the project would be a waste of time."

THE CORPS refuses to accept responsibility for erosion. Only after "careful study" — five or more years — will it alter the jetties, paid for by the authority.

The corps several weeks ago spent about $90,000 to dredge sand — presumably from the beach — deposited on the channel between the jetties.

At a meeting this week in Jacksonville, sponsored by Sen. Lawton Chiles, Corps public relations officer Gene Brown called a corps-authorized study of the inlet "merely a routine study we make whenever we put in a new structure. We try to determine the effects — where the sand is going compared with where we thought it would go before we built the jetties."

Sunday, April 29, 1973 3—B

Currents are building two sandbars from the inlet about a mile south, but the corps denies it is responsible for erosion.

EARLY THIS month three new men apppointed by Gov. Reubin Askew, joined the five-man authority board. Privately they say — with or without the corps — something must be done about erosion.

The contract says only the corps can approve jetty changes.

Leon Van Wert, port authority attorney, believes that body might push for an independent study of the inlet.

The attorney called authority fund raising for inlet design and changes "a definite possibility."

THE DAYTONA Beach Chamber of Commerce cited "serious" beach erosion in a letter to the army engineers and demanded "immediate remedial action."

A study to determine what needs to be done at the inlet could cost $50,000 and could be completed in several months, local engineers say.

A beach "nourishment" project to replenish sand in the badly eroded sections of beach could cost $500,000.

ENGINEERS SAY making the changes in the jetties would be inexpensive.

Van Wert noted the port authority would still need approval from the corps to make the changes in the jetties, "but if we went to them with a study which proved the jetties are causing the problem and a proposal to correct the problem with our own money, I don't think they would turn us down."

One member of the port authority agreed and added: "Why should the Corps object? We'd be spending the money to correct their mistake."

The port authority now has about $500,000 originally earmarked for construction of a port which could be diverted to pay for changes in the jetties and could levy up to one mill (about $725,000) a year to pay for improvements.

STUDENT COMMENT NO. 38 : Ecological Considerations

Sample questions for land developers:

1. What is the function of the dune in relation to the barrier beach?
2. How will the development of the barrier beach aid the dune function?
3. What effects will changes in wildlife habitats have on the wildlife naturally there?
4. What methods will be used to determine which vegetation to protect?
5. Which vegetation will be protected?
6. What are the advantages of the development on dune and tidal marsh environments?
7. What changes in winds (i.e. directions, velocity) will result from development?
8. What is the significance of a healthy tidal marsh as a nursery for marine life?
9. What changes in temperature will result in development?

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STUDENT COMMENT NO. 39

Doing What Must Be Done

Last May 11,* Brevard voters defeated a proposal to levy a half-mill county tax to finance a beach erosion control plan.

Last Thursday the Brevard County Commission decided to spend $160,000 as its share for such a project, which will be helped considerably by state matching funds and a federal grant of $320,000 for a total of $640,000.

In taking this action, five commissioners over-ruled the majority voters of all Brevard. Isn't this dictatorship? Socialism?

The May referendum was defeated because not enough people care about Brevard's beaches.

Although the "mainlanders" come to enjoy the beaches on the weekends, they do not want to pay for their perpetuation. Perhaps they figure that if the beach lasts as long as they want to use it, that's enough.

Even the retiree who lives on the beach strip is apathetic. He fishes, plays golf, comes home, has a drink, watches television. He worries not about the beach which is the only tourist attraction Brevard has. He doesn't even care if no tourists ever show up.

In a nutshell, few care about any one or anything except themselves.

This attitude is apparent far beyond the boundaries of Brevard. In Florida, it crops up when people start talking about the Everglades jet port, the Cross-Florida barge canal, Lake Apopka, the paper mills. Across the nation, it is apparent when people start wondering about Ohio's Cayahoga river, so polluted that it actually caught fire and burned down two bridges.

The average Brevardian, and American, continues on his way unconcerned when told that we consume twice as much oxygen as our plants are producing while destroying one million acres of oxygen producing forests per year; that 1,300,000 Ponderosa pines in the Los Angeles basin actually were killed by air pollution; that while a child is born in the U.S. every nine seconds, a car is produced every five; that motor trucks in Manhattan average 6 m.p.h. while in 1910 horse drawn trucks averaged 10 m.p.h.; that when the average American drinks a glass of water, it has already passed through five other people; that mother's milk contains three to ten times the amount of DDT permitted by law in commercial milk.

When Brevard's commissioners reversed the Brevard voters on the beach erosion referendum, they did so for Brevard's own good.

*1971

Wipeout!

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TEACHER COMMENTS

TEACHER COMMENT NO. 1 : Living/Non-Living?

One of the hardest things for a student to do is to decide what is considered biotic or abiotic. If biotic is defined as living or recently living, it must be determined what constitutes life.

Life involves ten basic processes that are integrated into a single product, that of living. If any of these functions are absent, then the object being investigated is not alive.

The ten elements of life are as follows:

1. Nutrition (food getting)
2. Locomotion or motion
3. Irritability (sensitivity)
4. Digestion
5. Absorbtion
6. Assimilation
7. Circulation
8. Secretion
9. Excretion
10. Reproduction

This is an all inclusive list of elements. Other scientists use lists of varying size but most place two or three of these basic elements into other encompassing categories.

TEACHER COMMENT NO. 2: Evaluating Small Group Work

Many teachers refuse to incorporate small group work in their classrooms because they lack a satisfactory procedure for evaluating the outcome of such efforts. For the purpose of this unit of study, we suggest the use of the following process for checking the results of groups investigating each Inquiry Question. Use only where it is practical to do so.

1. At the end of the study of each Inquiry Question, there will be an exercise in the Learning Activities column entitled Check I.Q. At this point have each individual within a small group write out what he thinks is the answer to the Inquiry Question, by filling out the upper half of the I.Q. (Inquiry Question) Check in Student Comment No. 1 , Page 32.
2. Teacher collects I.Q. Check sheets and gives to a different small group for grading.
3. Class members will:
   a. Have in front of them a copy of class conclusion for the Inquiry Question arrived at during the Investigations.
   b. Decide how many total grade-points should be possible for the proper response to the Inquiry Question.
4. Each small group will compare the answer sheet handed it with class conclusion and then fill out that lower half of the I.Q. Check form. Experience has shown that more honest and serious evaluations are made when students do not know who is checking whose paper. The name of the checker on the I.Q. Check form is for the teacher only.
5. Return I. Q. Checks to teacher who may reveal scores to students.

If this method of evaluation is employed, it would be essential for students to remain in the same small group until completion is made of all investigations for any one Inquiry Question.

TEACHER COMMENT NO. 3: Origin of Unattached Bars

An offshore bar or barrier beach is a sand bar that runs parallel to a straight shoreline and is nowhere attached to it. Offshore bars are common wherever straight shorelines with gently sloping sea floors are found.

The origin of offshore bars is not certain. Geologists think that at least some offshore bars may have been formed when large spits were separated from the mainland by storms or by a rise of sea level after the Ice Age. Until recently another theory was most in favor. This theory holds that offshore bars are long piles of sand scooped up in the zone of breakers by the scraping action of the breaking waves on smooth, sandy sea bottoms. Shore currents may also bring sand to help build the bar. When a bar grows to sea level, its surface may be raised still higher by wind and waves.

An offshore bar protects the shallow water on its landward side from winds and waves. This area of quiet water between the bar and the mainland is a lagoon. Lagoons may become salt marshes through filling with sediment and growth of vegetation.

Namowitz, Samuel and Donald B. Stone, Earth Science: The World We Live In, American Book Company, New York, 1969, pp. 312.

TEACHER COMMENT NO. 4: Large Group Discussion • Evaluation

The following checklist is offered as an example of a device which may be used to lend a degree of objectivity to evaluating student participation in class discussions. The teacher may involve students in the evaluative process by devising a rotation system whereby two or three students would evaluate class members during class discussion periods.

When evaluating student comments in class discussion consider the following items:

a. Quantity of student contribution.
b. Content of student's remarks as these indicate knowledge of topic, critical and/or innovative thinking by student
c. Relevance of student's remarks to subject under consideration.
d. Clarity of expression and presentation by student.

Based on the four considerations above, points should be awarded on a five point rating scale:

5 points-excellent
4 points-above average
3 points-average
2 points-below average
1 point-poor

Separate points should be given for each comment made by a student and recorded in the appropriate column in the sample Evaluation Sheet for Large Group Discussion below:

Evaluation Sheet for Large Group Discussion

NAME	POINTS	TOTAL
1. Sam Sunshine	4, 3, 4, 2	13
2. Mary Mushroom	1, 5, 2	8
3. Fred Frog	3, 3, 2, 1	9

TEACHER COMMENT NO. 5: Changes in Brevard Beaches Between 1966 and 1973, and Probable Causes

Listed below are some changes and probable causes for those changes which have taken place along Brevard County's beaches between 1966 and 1973. The pictures in Student Comment No. 's 11-15, pages 42-46, depict the 1966 conditions in selected beach sites, while slides 11-20 illustrate the same locations in 1973.

Slide No.	Picture No.	Location	Change/Cause
11	1(SC#11, p.42)	South Side of Canaveral Harbor	Beach is cleaner with little or no visable erosion
12	2(SC#11 p.42)	City of Cape Canaveral	Less slope to beach in 1973, due to natural erosion
13	3(SC# 12 p.43)	Fisher Park-Cocoa Beach	Beach has less of a drop off in 1973, due to natural erosion
14	4(SC#12 p.43)	Cocoa Beach-East end of Minute-man Causeway	Less slope or drop off in 1973, due to natural erosion
15	5(SC# 13 p. 44)	Officers' Club Patrick Air Force Base	Less sand along bulkhead in 1973, because there is no sand above the man-made bulkhead to wash down and replace eroded sand.

16	6(SC# 13 p.44)	NCO Club Patrick Air Force Base	Since man built this dune in 1966, from sand excavated for the NCO Club, nature has eroded the dune, leaving a considerable drop off.
17	7(SC# 14 p.45)	Satellite Beach Sand Piper Towers	No evident change
18	8(SC# 14 p.45)	Indialantic 5th Avenue Beach	Shows an approximate three foot drop from man-made boardwalk between 1966 and 1973.
19	9(SC# 15 p.46)	Melbourne Beach	Shows active erosion from 1966 to 1973, caused by man building too close to water
20	10(SC# 15 p.46)	5 miles south of Melbourne Beach	Erosion between 1966 and 1973, due to natural causes.

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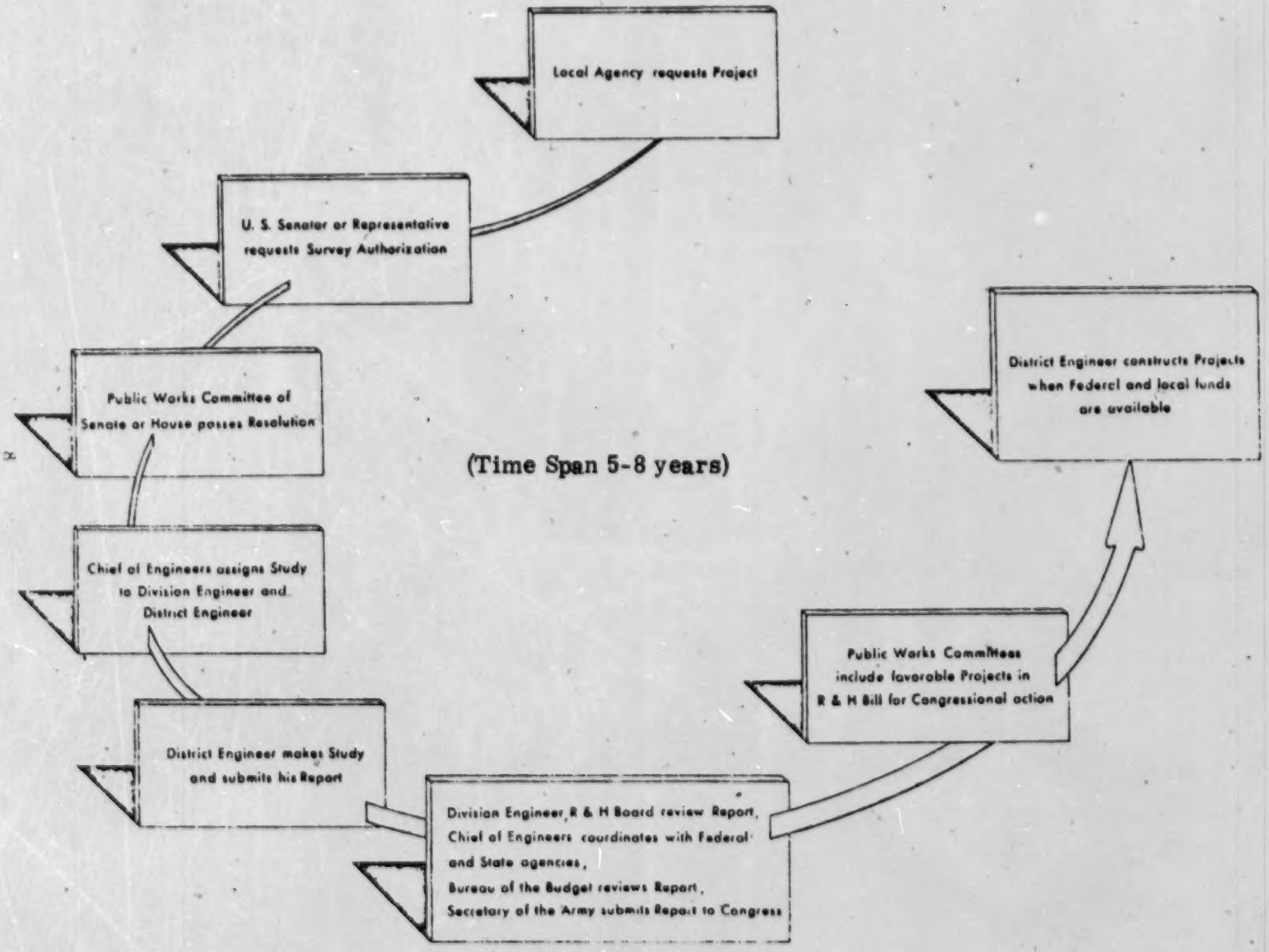
TEACHER COMMENT NO. 6: U, S. Corps of Engineers' Procedures for Regular Beach Erosion Control Projects



TEACHER COMMENT NO. 7: Evaluation Form For Oral Report
(To be filled in by students and/or teacher)

Subject of Report _____ Student reporting _____

I. Knowledge of subject matter and/or what way questions were answered.

_____a. Excellent (5 points) _____b. Good (4 points) _____c. Fair (3 points)
_____d. Poor (1 point) Points Earned _____

II. Presentation of material by using audio/visual aids. Evaluate each aid used from 0--5 points.

_____a. Charts _____b. Maps _____c. Graphs
_____d. Guest Speaker _____e. Slides _____f. Films
_____g. Filmstrips _____h. Table Display _____i. Study Guides
_____j. Puzzles/Games _____k. Skits _____l. Other
Points Earned _____

III. Equipment used in presentation. Evaluate each aid used from 0--5 points.

_____a. Opaque Projector _____b. Filmstrip Projector _____c. Overhead Projector
_____d. Film Projector _____e. Globe _____f. Chalkboard
Points Earned _____

IV. Speaker's attitude towards listeners, tone, and quality of voice should be considered. Evaluate as #1.

_____a. Excellent _____b. Good _____c. Fair
_____d. Poor Points Earned _____

V. Evaluation of the participation of the members of the groups. (Use where applicable)

_____a. Excellent _____b. Good _____c. Fair
_____d. Poor Points Earned _____
Total Points _____

TEACHER COMMENT NO. 8 : Evaluation Form for Visuals

Four areas for the evaluation of visuals are suggested. Each area should be rated by the following scale: 5 points-excellent; 4 points-above average; 3 points-average; 2 points-below average; 1 point-poor. Note: part 4, Clarity, has four sub-areas which combine to make the total value for part 4.

Student's Name _____ Title or Topic _____

POINTS AREA OF EVALUATION

1. APPROPRIATENESS

_____ If the student has had an opportunity to select either the topic or method of his presentation, is the choice of either or both appropriate to the assignment?

2. ACCURACY

_____ Are the facts used in the presentation accurate? If not, where is the inaccuracy?

3. COMPLETENESS

_____ Does the presentation represent a complete statement or coverage of the subject (is there material or facts omitted which makes the presentation misleading)? If not, where is the presentation lacking?

4. CLARITY

Is the presentation clear to the viewer?

_____ a. Is the viewer readily able to determine the point or message contained in the presentation?

_____ b. Is the presentation free from unnecessary distractions? (pictures, drawings, etc.) which do not contribute to the purpose?

_____ c. Are the colors and sizes of lines, bars, and/or pictures suitable?

_____ _____ d. In the case of a collage or drawing, is the focal point clearly determined?

COMMENTS: _____

_____
(Total Points)

The Barrier Beach as an Ecosystem

Description of slides 1-10

Slide Number	Description
1.	Man-made cut through upland (Zone 4)*; beach daisy (yellow flower, dark centers), beach morning glory, saw (scrub) palmetto, sea oats.
2.	Pioneer plants in Zone 4; railroad vine, saw (scrub) palmetto, sea oats.
3.	Zones 1, 2, 3, and 4; beach daisy and sea oats in foreground.
4.	Zones 3 and 4; Australian pines (an exotic species imported to Florida to be used as a wind breaker. Root system unsuitable for beach dune stabilization), saw (scrub) palmetto, sea oats.
5.	Zone 4; beach morning glory (3" - 4" pink-purple flower), sea oats.
6.	Zones 2 and 3; abiotic conditions so severe here, very little, if any life is found; coquina rocks (sound shell), old mollusk shells, sargassum seaweed washed ashore.
7.	Zones 2 and 3; a fisherman's device for collecting sandfleas, a small crustacean used for bait; seagulls also feed on sandfleas at low tide.
8.	Zone 3; scavenging ghost crab (normally a nocturnal organism), assorted mollusk shells, sargassum seaweed.
9.	Zone 3; over the imprint of a human footprint, are species of algae, coquina rock (sand shell), ghost crab, sand flea, and various shells.
10. **	Zones 1, 2, 3, 4; Australian pines; evidence of human development of the beach upland (Zone 4).

* Zones of the barrier beach are explained in Student Comment No. 8, page 39.

** Slides 11-20 are explained in Teacher Comment No. 5, page 104 and are used in the investigation of Inquiry Question V, page 13.